LIBRARY OF CONGRESS
JAN 29 1900
SMITHSONIAN DEPOSIT.


# THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXII. No. 5. Whole No. 1,286. | NEW YORK, MONDAY, JANUARY 29, 1900. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

**Published** on each Monday of the year, at No. 32 Pine Street, New York.

**Collections** are invariably made directly from this office for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

*The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.*


## CONTENTS.

An Asterisk (*) denotes an illustrated article.


OFFICIAL NOTICES—

Thirtieth Annual Meeting of the New England Association of Gas Engineers ..... 161

Seventh Annual Meeting, Michigan Gas Association ..... 161

EDITORIALS—

Briefly Told ..... 161

Volume XVI., Proceedings American Gas Light Association—Death of Mr. John C. Adams—The Lamb and the Lion—The Picture of a Rogue—Notes.

Reminiscences of Bunsen and the Heidelberg Laboratory, 1863 to 1865, by H. C. Bolton, Ph.D. ..... 162

*Installation of Inclined Retorts at the Leigh Gas Works, England 164

American Competition—No. XVII.—By Mr. H. F. J. Porter ..... 165

The Utilization of Garbage for Fuel ..... 165

The Growing Necessity of Supplementing Water Power with Steam Plants ..... 167

The Durability of Paint, by Mr. H. C. Standage ..... 168

Carbonic Oxide Absorbed by Plants. ..... 170

The Future of Electric Illumination—Part III.—By Mr. Jean Wetmore ..... 170

Special English Correspondence ..... 171

Coal and Labor Troubles—The Manchester City Council and Their Late Engineer of the Gas Department—Explosion at Douglas Gas Works—Carbide of Calcium.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES ..... 172

Annual Meeting, Lincoln, Neb.—The Electrolytic Litigation, Spokane Falls, Wash.—Annual Meeting, Portsmouth, Ohio—Annual Meeting, Hartford City (Conn.) Company—New Office Quarters, Auburn, N. Y.—Mr. E. G. Holzer Takes Charge at Phillipsburg, N. J.—A New Jersey Bill—Personal—Price of Gas Increased, Marquette, Mich.—Annual Meeting, Coldwater, Mich.—Sale of the Lynchburg (Va.) Plant—Annual Meeting, Mutual Company, Savannah, Ga.—A Chicago Gas Thief—Mr. Hintze Takes Charge at Lowell, Mass.—Mr. B. S. Reynolds Assumes His New Duties—Changes at Bloomsburg, Pa.—Annual Meeting, East Saginaw, Mich.—Cheaper Gas for Haverhill, Mass.—Increase in Stock, U. G. I. Company—Annual Meeting, Newburyport, Mass.—An Ordinance Repealed—And Many Other Items.

How Horse Power is Figured ..... 174

The Market for Gas Securities ..... 174


[OFFICIAL NOTICE.]

### Thirtieth Annual Meeting of the New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF THE SECRETARY,
NEW BEDFORD, MASS., Jan 24, 1900.

The Thirtieth Annual Meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, on Wednesday and Thursday, February 21st and 22d, 1900.

N. W. GIFFORD, Secretary.

[OFFICIAL NOTICE.]

### Seventh Annual Meeting, Michigan Gas Association.

MICHIGAN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
RACINE, WIS., Jan. 17, 1900.

To the Members of the Michigan Gas Association: The Seventh Annual Meeting of the Michigan Gas Association will be held in the city of Detroit, on Wednesday, the 21st, and Thursday, the 22d day of February next. Headquarters will be at the Russell House, where also the meetings of the convention will be held. Rates $3.50 and upwards per day for room with bath, and $2.50 and upwards without bath.

H. H. HYDE, Secretary.

## BRIEFLY TOLD.

VOLUME XVI, PROCEEDINGS AMERICAN GAS LIGHT ASSOCIATION.—We are in receipt of a copy of Volume XVI., of the Proceedings of the American Gas Light Association, which volume relates the transactions that were completed at the twenty-seventh annual meeting of the Association, held in New York City, October of last year. The book, as to its binding and printing, is in good form, but we venture to dissent from the method followed by its editor of separating the papers from the discussions. It may be a matter of taste, in which event none may dissent; but from our point of view, when such practice is possible, it would seem that relevancy is best served, by printing the sermon first, the report of the colloquy to follow immediately thereafter. However, we presume the editor knew best; and there's the end of it. The book contains an excellent likeness or picture of Mr. A. C. Humphreys, who presided over the deliberations of the Association's twenty seventh meeting, is thoroughly indexed, carries a well compiled register of United States patents relating to gas issued between dates of October 1, 1898, and October 1, 1899, with a recital of like patents that expired between the same dates, an excellent compendium of "current gas literature," and a list of membership in the Association that is altogether complete.

DEATH OF MR. JOHN C. ADAMS.—The news of the death of Mr. John C. Adams, President of the Consumers Gas Company, of Newburgh, N. Y., will be a shock to many; for, although he was in his 64th year, his physical nature was such that those who knew him well counted without doubt that his years would measure beyond three score and ten. His death, which was of startling suddenness, occurred the night of the 12th inst., and was attributed by his physicians to carditis. Deceased, who was born in Tivoli, N. Y., May 16, 1836, removed to New York, in 1854, where he was employed as a clerk in various mercantile ways. In 1858 he engaged in business in Rondout, N. Y., removing to Newburgh, in 1860, where he started on his own account in the grocery trade. Success attended his efforts, and in the late sixties he had become popular and prominent. Many offices of trust in and out of Newburgh were acceptably filled by him, notably those of Postmaster of Newburgh (8 years), member of the State Assembly (3 terms) and member of the City Council (4 terms—once its President). In 1880 he was elected President of the Consumers Gas Company of Newburgh, which had been established as an "opposition enterprise" to the old Newburgh Gas Light Company, if our memory serves aright, some two years before. In 1881 the rival Companies were consolidated,

and Mr. Adams remained in charge of the amalgamated enterprise up to the time of his death. He was a man who made friends and retained them, and his comradeship and heartiness will be missed for many a day in the hilly, handsome city on the west bank of the Hudson for the advancement of which he had done much.

THE LAMB AND THE LION.—The annual meetings of the Consolidated Gas Company, of New York, have heretofore been marked by that harmony which accompanies well thought out, sensible and honorable movements, but the annual meeting for 1900 was as turbulent as one could wish, no matter how fond were he of things disputatious. The annual meeting was held in the main offices (Irving Place) of the Company, last Monday, and a company of malcontents, headed by Mr. George A. Lamb, assisted by a field marshal named Felix Jellyneck, were on hand to declare that the Company was being mismanaged. That declaration was made in terms neither low nor mild. When the vote of the shareholders in respect of the naming of Directors for the ensuing year was counted, it was apparent that Lamb and his aide had been severely roasted, for the regular ticket received 281,919 votes out of a possible 390,078. The Lamb-Jellyneck contingent controlled something over 8,000 votes, but failed to exercise the privilege—about the only wise thing they did; for who or what were they among so many? The Directors chosen were: Samuel Sloan, John P. Huggins, F. A. Schermerhorn, H. D. Auchincloss, William Rockefeller, M. T. Pyne, George F. Baker, James Stillman, S. S. Palmer, Wm. C. Whitney, A. N. Brady and Thos. F. Ryan—the three last named are new members of the Board, and their appearance thereon is significant of a changed or changing era in the control of the artificial lighting interests of New York. As to the policy of the gentlemen in charge of the Consolidated Gas Company's interests we have no criticism to make; but we cannot forbear utterance to the thought that our local gas men could get along very much better without an electrical alliance than could the electrical men without a gas alliance.

THE PICTURE OF A ROGUE.—The JOURNAL is not given greatly to the practice of printing photographs of "great men," but in this particular instance we feel that departure from the ordinary course may be productive of some good. In recent issues we have been reporting the peculiar methods employed by a self appointed collector of gas accounts, whose work in Lowell, Mass.; Baltimore, Md.; Pittsburg and Allegheny, Pa.; Cincinnati, Ohio, and East St Louis, Ills., brought him quite a bit of money. He was finally landed in jail in East St. Louis, and so that by his face he may hereafter be known among gas men its lineaments are submitted—for the photograph we are indebted to Mr. Henry Maguire, Superintendent of the East St. Louis Gas Works. To make the identification all the more complete the following additional particulars are submitted respecting his personality, which particulars are taken from the records of the East St. Louis Police Department: Name, Chas. Hastings, alias Montague; age, 41; height, 5 ft. 7½ ins.; weight, 140; eyes, brown; complexion, sallow; hair, gray; build, slim; scar on base of left thumb, inner.

NOTES.—The plant and franchises of the Brockport (N.Y.) Gas Light Company have been sold to Messrs. W. H. Fritchman and associates, who assumed possession thereof the 15th inst. The officers are: President, W. H. Fritchman; Treasurer, Allan Semple; Secretary, M. S. Decker.——At the annual meeting of the Laclede Gas Light Company, of St. Louis, Mo, these officers were elected: Directors, E. McMillin, F. Edey, Jas. Campbell, I. H. Lionberger, Geo. A. Madill, J. C. Van Blarcom, Jno. Scullin, P. J. Doerr and H. Scullin; President, E. McMillin; Vice President, Jas. Campbell; Secretary and Gen. Manager, A. Ross; Treasurer, C. J. Owen; Assistant Secretary, C. L. Horton. ——Mr. George B. Neal, the veteran Manager of the Charlestown (Mass.) Gas and Electric Company, lost his watch some time ago—we told of the loss the time it happened. We can now say he has another one. It is a beauty, and was presented to him by the men who work under and with him. The presentation speech was made by President Hunnewell; the reception speech was unreported, simply because Mr. Neal's accustomed loquacity was completely "knocked out." Long may he live to tell the time of day.

## Reminiscences of Bunsen and the Heidelberg Laboratory, 1863—1865.

By HENRY CARRINGTON BOLTON, Ph.D., in *Science*.

I first met Bunsen in the lovely, retired valley of Engelberg, Switzerland, during the summer of 1863; I had spent the preceding twelve months in Paris, working in Dumas's laboratory at the Sorbonne, and in the Ecole de Mélecine under Wurtz, and was expecting to continue my studies in Heidelberg. Learning by accident that Bunsen was at an adjoining *Gasthaus*, I called on him and told him of my plans; he received me graciously, and immediately won my heart by his affability, by the charming smile that lit up his large features, and by his unselfish interest in my personal affairs. Being myself quite ignorant of the German language we conversed in French, and he gave me useful hints as to the opening of the University laboratory.

My first *semester* at Heidelberg was devoted almost exclusively to laboratory work, but I attended Bunsen's lectures on general chemistry every morning at 9 o'clock in the adjoining auditorium. Bunsen's habit of saying one word when he meant to use another was at first puzzling, particularly as I was very weak in German, but when he exhibited the violet vapor of iodine and called it chlorine my previous knowledge of chemistry assisted comprehension. After every lecture Bunsen rarely missed spending several hours in the laboratory, going from student to student with inquiries, suggestions and useful hints. Desirous of securing my share of this personal contact, I soon found the best way to induce the Hofarth to linger was to have a supply of clean test tubes and beakers on an orderly desk, with a query or two requiring experimental answers. Any suggestion as to the use of the spectroscope in connection with a substance under examination was sure to interest the Professor, as that famous instrument was a comparatively new adjunct to chemical work, being then about four years old.

When in the laboratory Bunsen habitually carried between his lips a short, unlighted cigar, and he often stopped at a student's desk only long enough to light the tobacco at a "Bunsen" burner; in a few minutes the cigar was again without a spark owing to his absent-minded neglect to pull on it. Absent mindedness was a marked trait in Bunsen's character. and many amusing anecdotes are told of the difficulties it brought him. The statement that he remained a bachelor because he forgot his wedding day is of course, apochryphal, as is the other about his putting on a suit of garments on top of others that he had forgotten to take off; but the following came under my personal observation. Bunsen used to dine every day at a little table reserved for him in a restaurant connected with the hotel in which I lived; one spring he fell into the habit of ordering veal cutlets and asparagus as the chief item for his meal, and, without reflection or feeling that a change of diet would be agreeable, he continued to order "*Kalbs-cotelette und Spargel*," daily for several weeks, until one day the *Kellner* gravely informed him that asparagus was no longer in season and could not be supplied. Bunsen seemed to be immensely taken aback, and to realize for the first time that he had been dining on one dish for a long period; he soon recovered himself, however, and asked the waiter for the bill of fare, from which, after careful examination, he ordered mutton chops and peas, and this was his daily diet up to the time I changed my hotel.

When the laboratory was closed for the Christmas holidays I tried to get permission to work in the deserted rooms, but in vain, and not wishing to be idle I worked at growing crystals, improvising a desk out of a hotel washstand, and a heater out of the huge porcelain stove. Some time after I showed to Bunsen a single crystal of copper calcium acetate about 3 inches long, with perfectly regular facets, and of which I was quite proud; he looked at it rather solemnly, as I thought, and enunciated the single word "*ausgezeichnet.*" This was not in my limited vocabulary, and whether a commendation or a disapproval I could not divine. I puzzled over the word all day, and on returning home the dictionary explained its meaning to my great satisfaction.

As my knowledge of German increased I attended the lectures of Kirchoff and of Kopp, but I never was able to *enjoy* the latter's interminable sentences and involved style.

Bunsen's assistants in the laboratory at the time of my sojourn were Dr. Dender and Dr. Rose; the latter had the reputation among the students of giving more accurate instruction in mineral analysis than Bunsen himself. Rose is now Professor in the University of Strassburg.

Bunsen's methods in mineral analysis were not wholly approved of by the students. One day he stopped at my desk for a moment, and picking up a filter containing a moist precipitate he inquired, "What

have you here?" Seeing with consternation a portion of my *quantitative* precipitate sticking to his thumb, I hastily seized a "*Spritzflasche*," and washed the substance off his thumb into the filter on the funnel before venturing a reply. Bunsen smiled genially and passed on to my neighbor.

Bunsen showed extraordinary callousness to heat, being able to hold in his fingers metal nearly red hot; on one occasion, when stirring a glowing crucible with a very short spatula, his skin fairly sizzled and for relief he took hold of the lobe of his ear with his smoking thumb and forefinger, explaining that the ear was the coolest part of the body.

The celebrated Dr. C. R. Fresenius, of Weisbaden, having appropriated some discovery or method of Bunsen, without giving credit, was cordial y disliked by him, and he once showed it by a significant act. A student accosted the Hofrath as he passed by and put to him some simple question in analytical chemistry; on the desk lay open a copy of Fresenius's "*Anleitung*," whereupon Bunsen closed the book with a deprecatory gesture, pulled out the drawer of the student's desk to its extreme limit, and thrust into it as far back as possible the objectionable volume, saying, "*Nun, mein Herr*, we will proceed."

Bunsen was rather sensitive to criticism; one of my American colleagues tells me of an incident illustrating this. The Professor proposed to the student the joint preparation of certain cæsium and rubidium salts, saying he would secure several barrels of the mineral water rich in the chlorides, and would have the water boiled down to a small volume ready for the separation of the rare elements. The American felt highly pleased at the flattering proposal, and to show his interest in the matter mentioned that he had studied under Professor O. D. Allen, of New Haven, who had done work on cæsium and rubidium. This was an unfortunate remark, however, for Allen had corrected Bunsen's figures for the atomic weight of Cs, and the Hofrath remembering this never again mentioned the subject to my friend.

In those days students were obliged to prepare some substances now commonly provided, and to construct some apparatus with their own hands. Every student had to etch and calibrate his own eudiometer, and some of them wasted much time over the hydrofluoric acid process before getting good results. I remember, too, purifying potassium hydroxide by solution in alcohol (an extra charge), and evaporation in a large silver basin loaned by an assistant. One green, Russian s udent bought at Desaga's, potassium cyanide instead of the hydroxide, and was vainly trying to dissolve it, walking about the laboratory shaking the bottle for hours, when Bunsen noted its singular appearance, caused the operation to be suspended, and on ascertaining the nature of the substance cautioned the student against it.

Speaking of Russians reminds me of an amusing occurrence: One of them was instructed to precipitate a substance "*mit überschüssigem Kali*," and not finding any bottle labeled "*überschüssiges Kali*," he inquired for it of a neighbor, who mischievously sent him to Dr. Bender, telling him the article was kept under lock and key with other costly substances, such as silver nitrate and platinum chloride. The astonished assistant explained to the Russian that an *excess* of potash did not require a special bottle; the student was nicknamed "*Uberschüssiges Kali*" for the rest of the *semester*.

Many nationalities were represented in Heidelberg laboratory; besides Russians there were Bessarabians, Hollanders, Bohemians, Germans from north and from south, Austrians, one Chilian, one English man (the late Dr. Walter Flight, F.R.S.), one Scotchman (Mr. Sims), one Irishman (Mr. John Price), and several Americans, 59 students in all, of which 58 were incessantly smoking; the fumes of tobacco mingled with vapors of $H_2S$, $SO_2$, $HNO_3$, and $NH_3$, making an atmo sphere so thick that I regret not having cut off a slice as a souvenir.

The students, from time immemorial, had a voluntary organization to maintain order in the laboratory; they elected at the beginning of of each *semester* an officer known as "*Polizei-Diener*," who was authorized to impose small fines for petty offences, the money thus secured being devoted at the end of the term to the purchase of books for the small library placed on shelves in the balance room. This cus tom I understand still obtains. At the opening of my third term I was elected "*Polizei*," and duly instructed in my duties; being watchful and courageous I collected more money during my term of office than had been added to the library fund for many years. The misdemeanors for which fines were imposed were "Leaving an unused gas burner lighted; failure to resort to the "*Stink Zimmer*" when noxious gases were generated; failure to replace bottles or apparatus used in common, and leaving a balance door open or weights on the pans, which latter was accounted a very heinous offence; the fines ranged from 6 kreutzers (Baden) to half a gulden. My official life was marked by two events that greatly excited and amused the whole laboratory; one of the events was regarded as an exhibition of unparalleled audacity, of which only an American was capable—I fined Hofrath Bunsen! The Professor, after lighting his cigar at the flame of a Bunsen burner, left the gas burning and went out of the room; according to custom, and to the consternation of the students, I chalked on the desk that Bunsen had used, the words "six Kr." over my initials, a notice that could not be erased until the fine was paid. Next day when Bunsen approached the desk, he glanced at the inscription, smiled broadly, and, to the amusement of the crowd of students that had gathered to see the result of my daring, opened his purse and handed me the six kreutzers with a pleasant commendation of the fidelity of the "*Polizei*."

The other event concerned a very close-fisted American whose numerous fines I was unable to collect; when they reached the enormous sum of 1½ gulden (about 2s. 5d.) I consulted some of the older German students, stating the facts and asking for advice. They declared they had never heard of such a case, and they authorized me to confiscate some chemical apparatus belonging to the American and to sell it at auction. I secured a fine beaker glass, the outside one of a large nest, and after due notice, amid the shouts of the 59 students gathered in the lecture room, the beaker was sold at auction. The competition to secure it was so keen that it brought a very high price, the sum covering the fine plus the value of the glass. The excess had to be paid back to the lucky American, so that the fine did not come out of his pockets after all.

Several times in the course of his life Bunsen was injured by explosions; he was popularly believed to be minus one eye, one ear, and one lung, and there is some foundation for this, for he lost an eye when working at cacodyle, and he was slightly deaf. It was related of him that on one occasion a violent explosion threw him to the ground and made him unconscious; on coming to, his first words were: "Has any of the substance been saved?"

In 1865 Bunsen was invited to fill a chair in the University of Berlin, and after due consideration he declined the flattering call, to the delight of all educational Heidelberg. In his honor the students organized a torchlight parade; the chemists marched in a body, and carried away by enthusiasm I imprudently joined them, carrying a torch with the crowd. The procession paraded the principal streets, and then assembled in the open square before the *Aula* or central Hall of the Univer sity; there the students singing the Studenten Lieder and forming a ring, gradually closed in towards the centre, making the ring smaller, until at a given signal they threw their half-burned torches into the very centre and the pile blazed on high, making an impressive ceremonial. I have said I imprudently joined because I failed to anticipate the disagreeable consequences; the smoke of a half-a-thousand torches, the dripping grease, and the dust of the streets, combined with the moist exudation of my membranous integument, to form a black deposit that would have honored a stoker, besides ruining a suit of clothes.

During my residence in Heidelberg a lamentable and terrible affair took place that threw a profound gloom over the University and the entire town. Two German students having quarrelled decided the earth was not large enough for both of them to live in, and resorted to the diabolical practice called the "American Duel." In a darkened room the two young men drew lots, having sworn that he who drew the black ball would commit suicide. The unhappy loser went to his room and discharged a bullet into his breast, but missed his heart and lingered for several days on his death-bed; his parents were summoned by telegraph, and besought him on their knees to disclose the name of his antagonist, but he steadfastly refused and died with the secret in his breast. The students not only excused his conduct, but praised his courage, and when his remains were taken to the railway station to be transported to a distant city, they accompanied the funeral cortège with torches and music. The students claimed he was not a suicide, for he was killed in an honorable duel, and they maintained that his opponent was not accessory to his death because he shot himself: I had many arguments with them, and never could convince them of their extraordinary tergiversation.

The whole system of duelling at Heidelberg is an interesting feature of student life that I had good opportunities of observing without taking part; but, as Kipling says, "that is another story."

The intimacy of Bunsen and Kopp is well known; I have often seen them walk through the narrow streets hand-in-hand like affectionate school girls, Bunsen's large frame and Kopp's diminutive stature making a strong contrast.

Bunsen had great talents and personal attractions, yet he did not succeed in fostering original work on the part of those who studied with him; I think this is partly due to the fact they were chiefly

beginners, and when they had acquired the rudiments of general chemistry they took to the fertile fields of organic chemistry under other masters. Yet his pupils include some men of high rank in the profession—Lothar Meyer, Sir Henry Roscoe, Beilstein, Lieben, and Carius.

I last saw Geheimerath Bunsen during a brief visit to Heidelberg in 1891; he had retired from active duty and complained of the infirmities of advancing years, being subject to rheumatism, but he exhibited the same cordial manner, the charming smile, and a willingness to listen to the accounts of Americans who had pursued their studies in the Heidelberg Laboratory. Bunsen died after a lingering illness, August 16, 1899, at the great age of 88.

Of the charm of residence in the picturesque little city on the Neckar, with its magnificent ruined castle, its attractive forest-covered hills threaded by enticing paths, its historical associations, and its excellent beer, there can be but one opinion; but in winter we often felt the truth of the old couplet:

"Heidelberg ist eine schöne Stadt
Wenn es ausgeregnet hat!"

## Installation of Inclined Retorts at the Leigh Gas Works, England.[1]

About eighteen months ago, a Local Government Board inquiry was held at Leigh (Lancs.), with respect to an application made by the District Council for sanction to the raising of $125,000 for the extension of the gas works, necessitated by the great increase which had taken place in the population and manufactories during the past few years. This was clearly shown by the figures submitted to the Inspector, on the occasion referred to, by the Clerk to the Council (Mr. P. Thomas). He showed that, whereas in the year ending March 31, 1888, the output of gas was about 54½ million cubic feet, and the number of consumers 1820, on the corresponding date in 1898 the figures were 110¼ millions and 4,480 consumers—an increase to the extent of 101 per cent. At the date of the inquiry, the maximum daily make of gas was 607,000 cubic feet; but it was expected that in the succeeding winter it would be 700,000 cubic feet. The manufacturing capacity of the works

1. *Journal of Gas Lighting*,.

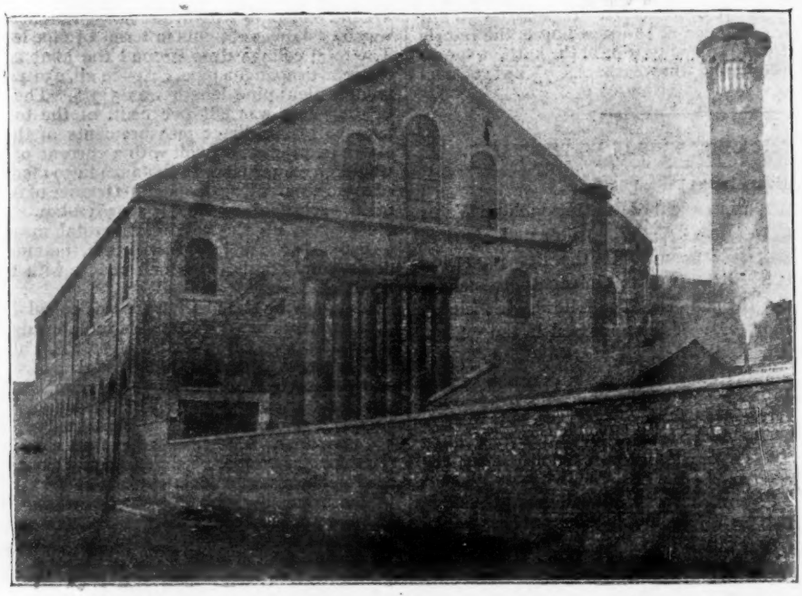


**Fig. 1**—New Retort House at the Leigh Gas Works.

**Fig. 2.**—Charging Stage.

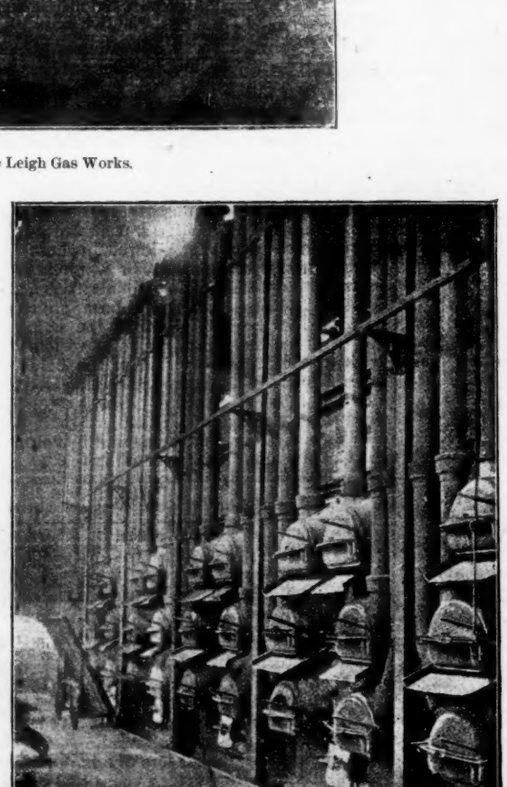


**Fig. 3.**—Drawing Stage.

had already been raised by the provision of 98 new 10-feet retorts in 1893; but it had been decided to replace them by 42 others of double the length. The Gas Engineer to the Council (Mr. John Foster) had devised a scheme for the projected extensions, and this he submitted to the Council towards the close of 1898, accompanied by a statement showing the advantages which would accrue by carrying it out. The detailed cost of the new plant amounted to $133,975; but deducting $17,500 for old materials, the total sum required to be spent would be $116,475. The saving to be effected by the change of retorts was expected to be about $5,010; in coke, $750; and in men's wages, $360—making a total of $6,120. The tenders which had been received for the projected works were opened early last year; and it was resolved to accept that submitted by Messrs. Graham, Morton, & Co., Limited, of Leeds, for carrying out an installation of inclined retorts in the new retort house. This building is shown in the accompanying illustration (Fig. 1). It is 150 feet long, 50 feet high to the eaves of the roof, and 88 feet span. It has been constructed entirely of red brick, relieved by stone courses; and it is of sufficient width to take the bench of retorts and the coal stores along side. The contract was started on the 1st of June last, and comprised the following work: Putting a new roof (slated) on the building; taking down the old retort bench, and laying the foundations for, and erecting the new one, including the main piers, arches, furnaces, retort fittings, superstructure, storage tank, elevating and conveying machinery, boiler and seating, economizers, main flue, etc.—all within the building. This work was completed on the 30th of September—less than five months from the start, which is certainly highly creditable to the contractors. Figs. 2 and 3 show the drawing and charging stages of the new house, the retorts in which are 20 feet long and 26 inches wide at the bottom, tapering to 22 inches at the top; and they carbonize 7½ cwt. of coal per charge.

---

[From *Engineering*.—Continued from page 128.]

## American Competition.—No. XVII.

By Mr. H. F. J. Porter, M. E., Bethlehem Steel Company, South Bethlehem, Pa., U. S. A.

I am given to understand that there is a well defined feeling abroad that American competition has become a menace to England's manufacturing interests, and I am asked my opinion as to the causes which have brought about this condition of affairs, and what remedy, if any, can be applied. If the situation is as stated, if England is just opening her eyes to the seriousness of her position, and is only now beginning to take steps to relieve it, perhaps we may see in these facts a racial deficency in perspicacity which, if it exists, would in itself be crucial.

Human nature may be the same the world over, but certain characteristics are more pronounced in some people than in others, and these differences make for, or check progress. For instance, our perception is generally dull to the effect of the gradual changes that are taking place about us, and our ability to formulate our thoughts into language, acts more slowly than our senses, so that when we see and feel these changes, considerable time elapses before we become sufficiently impressed by them to state our ideas and give logical reasons for their existence. Then again, when the reality begins to assert itself, there is often a tendency to adopt a ready made phrase to express our sentiments, due possibly to a mistaken idea that it does not fall within our province to give the matter careful investigation.

Even when the situation becomes clearly defined and our duty is ap parent, we are prone to postpone individual action, fearing its futility. United action requires leadership of a type not always available, so that until the situation becomes so unbearable as to affect us personally we make no move. If my understanding of the situation is correct, these characteristics must be unusually pronounced in the English people.

Such a change in commercial conditions as that under consideration is slow in maturing. There are in general too many contending interests to allow of rapid alteration of methods. When, therefore, we hear that a new condition of things is assuming form, if it is sufficiently obvious to be recognized at all, we can depend upon it that it has actually existed for a considerable length of time.

In point of fact, statistics have long shown the ebb and flow of the tide of trade so plainly, that Englishmen, had their business acumen been acute, would not have waited for the recent succession of losses of large contracts to awaken to the situation. But Englishmen, it must be acknowledged, know how to accept temporary defeat and profit by experience.

As in war, so in commercial rivalry, nothing is accomplished by despising an adversary. The only way to overcome him is to study his methods, in order to profit by the knowledge gained.

The editors of *Engineering* have gone about attaining this end, and obtaining an analysis of the situation very much as did the minister who found his congregation dwindling away. He sent out a circular letter to the people of his parish asking them why they no longer came to his church, or why they went to another. He soon obtained the reasons he was seeking for, but he also found that if he wished to meet the requirements given as necessary for the return of his people, he would have to reconstruct himself on entirely new lines, and being no longer a young man, and therefore set in his ways, it would be difficult and perhaps impossible to regain his former popularity. There were two alternatives open to him to select from, before closing up his empty church. Should he on the one hand try to adopt the methods adopted by his more successful brother, to whom his congregation had flocked; or on the other, was not the situation after all a temporary or traditional one in which, guided by his own matured advice, based on broad views gained by long experience, a young and resourceful assistant could meet the present crisis? It did not require long reflection to convince himself that imitation could never equal the original, and the second alternative was finally considered food for reflection. In the present issue it is likewise presented as offering a possible solution of the problem.

The factors entering into the causes of change in industrial conditions are many and varied, and scientific reasoning regarding them, may be true or false with equal probabilities. It must fall back finally upon trial, and success or failure in the future to prove its case.

But whatever the inference, there is no escaping the fact that such changes take place along lines of least resistance. When, therefore, an effort is to be made to counteract a move in the process of development, these lines must be strengthened beyond the ability of the attacking force to penetrate them.

The chief reasons why the older nations fall by the way is that the thickness of the warp and woof of the mantle of customs and laws that was woven to protect them, prevent their adapting themselves rapidly to the changing conditions of their environment. Such changes, if permanent, are steps in the march of progress, which are directed by unyielding laws working with extreme severity towards the consummation of an inscrutable plan.

England's manufacturing industries, old as the nation itself, weighted down by traditions which have incrusted them, rumble along the highway of trade in ruts so deep that they can with difficulty be extricated. There seems to be an orthodoxy in matters commercial which has been adhered to with a faith stubborn to conviction. Whatever may be the reason, it seems to be true that the Englishman adheres to his ideals longer than his American cousin, and when finally he awakens to the fact that they are destroyed, he receives a shock which apparently bewilders him.

Americans have had no standards. Their knowledge in general has been derived from precedents, and a proper selection of the good from the bad experience of the past. They have adopted the best devised methods of reducing cost, and raising quality of product, regardless of the expense attending such a policy, trusting to their soundness to bring about satisfactory results.

It is still a question in the mind of sociologists whether the method adopted to turn out work quickly and cheaply is not developing a country of specialists who have not the deeper knowledge of affairs which eventually determines the greatness and soundness of a nation. Americans, however, possess a self-confidence in their resourcefulness in cases of emergency which has stood by them in the past, and will in all probability not fail when the next necessity for it arises. But even if Englishmen may satisfy themselves by the most logical reasoning that the methods of American competition will eventually react upon their body politic, the fact still remains for England to consider now that when her trade is gone, it is gone, and it does not require demonstration to prove that it is easier to hold possession than to get it back after it has been taken away.

Improvement comes from sad experience, and, as in civilized society, self-protection demands laws leading to the betterment of conditions, so also the protection of commercial interests leads to the establishment of regulations, which make for improvements affecting mutual welfare. Thus it would seem that the situation in England demands that some existing laws be modified, and that others be enacted to meet the impending situation. There must be no compromise with expediency. Politics must not enter into the question. Such laws must be enacted at the behest of the united manufacturing interests of the country, which must come together for deliberation and determination.

The man who has sense enough to know that the fabric of customs and laws which has taken a thousand years to weave, cannot be disrupted in as many days, will find himself a long way on the road in the right direction towards advocating effective legislation. It is to be borne in mind in considering a commercial race between two nations, that there is no limit to progress, and that there is plenty of time. That nation which promulgates and adheres to the best methods will reach the goal first and hold it. That ever present problem, the so-called "labor question," must be met in England as in America, through a more thorough understanding by employer and employees, and of what those two classes owe to each other. Such an understanding can come about only through education in social science in the public school, the university, and by the press. It would pay the labor unions well if they would employ the ablest political and social economists of the nation as their leaders, and to represent their interests at the councils of the manufacturers. The situation must be studied by specialists in organization and management. Provision must be made in the technical schools for courses in manufacturing engineering, where specialists of this type can be turned out. New shops should be organized under their direction; old ones gradually regenerated by their suggestions. Thus the most practical and scientific methods would be adopted which, with an individuality adapted to each case, would lead to rapid progress in eliminating error.

Conflicts will arise between theorists and practical men, but success will attend those who with tact have the courage to adopt a broad policy of management. The question would soon be, not whether a manufacturer can afford to adopt such a policy, but whether he can afford not to adopt it.

It is an ever true maxim in life, and one especially applicable to the present instance, that the only successful method is one which will produce the best results with the least expenditure of time and money. Once such a method has been adopted, and the opposition it creates has been crushed or worn out, it is surprising how it will persist. It is like a tender but prolific herb implanted among other vegetation which may be hardier than it is. Give it every opportunity to start, with soil, moisture, sun and air favoring, and it will overrun its neighbors to their extinction.

All about is the great mind of the universe ready for absorption. I take it for granted that England's commercial interests will move to assume a more favorable attitude towards it. Undoubtedly blunders will be made in the process, but it is only by doing something and correcting mistakes as we make them, that progress is made. The man who does nothing fearing that he will err, gets nowhere and is left behind.

So if in the future, English enterprise fails to develop along modern lines, it will be because negative influences overpower those that make for progress, and hold it down to where it is and has been.

In situations as complex as this the most astute reasoner has no precedent on which to base his arguments. He may perhaps have temerity enough to point out the way, but it is doubtful whether those to whom he may address himself, would or could accept his suggestions. No two men would agree with him.

"We see by the light of thousands of years,
And the knowledge of millions of men,
The lessons they learned through blood and in tears,
Are ours for the reading, and then
We sneer at their errors, and follies, and dreams,
Frail idols of mind and of stone,
And call ourselves wiser, forgetting it seems,
That the future may laugh at our own."

## The Utilization of Garbage for Fuel.[1]

The recent merger of leading gas and electric light interests in New York has led to a discussion in the columns of the New York *Times* which is of so much general interest that the contributions of Messrs. George Westinghouse, Robert H. Thurston and Cary T. Hutchinson thereto are here reprinted:

*By Mr. George Westinghouse.*—The bringing together of the gas and electric light and power interests in New York should result in great advantages to the public and to the interests so combined, provided the latest developments in gas and electric engineering are investigated and availed of. Among the numerous questions affecting the health, comfort and convenience of the citizens of New York (and of all communities, in fact), are three of special importance, viz.:

The disposal of garbage, the abatement of the smoke nuisance due to the increasing use of bituminous coal for steam power purposes, and the securing of an adequate supply of water.

From statistics there appear to be created daily in New York about 500 tons of garbage, or at the rate of one-half pound per capita. Such garbage is about 20 per cent. carbon and 80 per cent. water. By a process which has been well demonstrated on a small scale, and which is being rapidly brought to a commercial basis, all of this garbage can be economically, and without offensive odor, converted into a fuel gas of great value. In the same apparatus and by the same process, soft coal can be made into a gas suitable for power and heating purposes.

The fuel gas made from garbage and soft coal can be used to drive gas engines with electric generators, and the electricity thus produced can be used for light and to drive motors to the exclusion of the thousands of steam engines and boilers which make such demands upon the water supply, since the gas engine central stations can be so located that the water needed for engine-cooling purposes can be taken from the river.

Bearing upon these questions, and of especial importance, are the partially executed plans of the electric power and light corporations, viz., the Metropolitan, Third Avenue and Manhattan Elevated railways and the New York Gas & Electric Light, Heat and Power Company and the United Electric Light & Power Company. If their present plans, which are fairly well known to the engineering profession, are carried to completion, each will have one large steam station on the East River, between Twenty-ninth Street and the Harlem River, with about 75,000 horse-power of engines, boilers and electric machinery, making an aggregate of 375,000-horse power, and which may be largely increased when the underground rapid transit railway is completed, and still further when the electric locomotive is used on all steam railways within the city limits.

If these corporations, which might as well buy electricity as the machinery, coal and water with which to produce it, were to unite in a common plan to provide the electricity needed in their operations by the adoption of the best available methods, the saving to each in capital expenditure would be very great, and the decreased cost of their supply of electricity would make an important addition to their earnings applicable to the payment of dividends; while, most important of all, the citizens of New York would have solved for them the garbage, smoke and very largely the water questions.

I believe the contemplated plans of the corporations above named, which can be shown to be based upon an imperfect knowledge of the subject, will stand in the way of vast public interests, and, so believing, I have said to representatives of some of those companies that the near future would demonstrate the projected power stations and systems of electrical distribution incidental to the character of such stations, to be as far from the best as are the old cable systems for the propulsion of cars.

*By Dr. Robert H. Thurston.*—I have been much impressed by the suggestions of Mr. Westinghouse's letter. It suggests thoughts far more wide reaching than at first may appear. The primary principle which underlies its text is that of the combination of all the essential public utilities in such manner as to insure the most economical production possible. This does not, in this case, mean so much a reduction of total costs to the public as an increase of availability of the product for the average citizen. When gas is permanently reduced to 50 cents per 1,000 cubic feet we may all use it in our kitchens and to some extent for heating and in manufacturing, while the city will employ it in making more extended and efficient the public lighting outside the range of the electric light. When the electric light can be supplied at a half or two-thirds its present average cost, the urban lighting of our communities will be doubled in area and efficiency, and the comfort of honest citizens and their safety and the repression of disorder and crime will be vastly greater than now. As is almost invariably the fact, the reduction of price and costs will be met not so much by saving as by extending the benefits of all utilities. When garbage can be made to contribute to our comfort and health instead of being a perpetual menace, our householders will find comfort in that fact, and our taxpayers will be relieved.

In every city in the country this combination of all sources of power in a single center and the production of heat, light, power and electricity, and the incineration, profitably and wholesomely, of all garbage, should be provided for. Such a wise and sound method of engineering these enterprises would enable many a small city or even village to supply its people with water and light, and to relieve itself from the dangers of typhoid-charged water and of fever-breeding garbage, whereas it must wait many years for the comforts of modern

1. *Engineering Record*

life. The gas, electric and water supply plants, and the garbage incineration arrangements should all be combined, not so much to reduce costs of product and of necessary expenditures as to make it practicable for our cities to secure well lighted streets, an ample supply of pure water—artesian if possible—for drinking and industrial purposes, a complete and useful disposal of refuse matter, and all at minimum charge in the tax levy. But it is the wide distribution of these great blessings rather than the reduction of the aggregate cost to the city of such charges that should be sought.

Mr. Westinghouse has himself done much to render this important change practicable, not simply in his contribution to the art of electric lighting, but also, and more extensively and in a more important degree than is generally realized, in his work in the direction of placing beside the steam engine as a source of industrial power a distinctly dangerous rival in the gas engine of large power, gas engines of 500 and 600, and, in a few instances, of 1,500 horse-power, and operating with exceptional economy, having already been produced. The scheme for the conversion of the potential energy of our garbage into useful power, as a part of the larger plan, is by these facts rendered so much the nearer practicable, and the day of this form of industrial extension so much the closer at hand.

We find ourselves, as Mr. Westinghouse himself has elsewhere stated it, in "a new industrial situation." Happily, it is one in which all parties to the present and older situation may be advantaged. The realization of this proposed modernization of the city public utilities in this manner will extend the market for the sale of electric light and for gas, and thus increase the profits, as always occurs, on the extended business. It will make our very wastes by way of the kitchen door a source of health and profit and free us from some of the most serious of all the risks and disadvantages of crowded city life. Where it is practicable in the usual case—in fact, to introduce the provision of needed power for a pure water supply in the scheme, the free use of wholesome water will become a continually growing source of health and comfort and godliness.

Nowhere in the world is there a greater opportunity offered for the full exemplification of this plan and its economical advantages than in New York, and nowhere is it possible to accomplish more for a crowded population than in that city. With pure water in plenty for the poorest, liberal use of electricity for light and power, and of gas, where suitable for lighting, and in the now common and economical forms of gas engine of every magnitude, from 1,500-horse power down, with sanitary conditions perfected by proper disposal of garbage and sewage, New York should become an ideal residence city. Nature has there done her best, and it only remains for man to do his very best in the light of modern science.

This is hardly less true of all large cities, but that is not the most or the best possible. The larger proportion of our people, so far as urban at all, live in small cities, and these may, under such ideal conditions as are here contemplated, become at a comparatively early stage in their growth well lighted, healthfully provided with water, and sanitarily insured against danger from refuse, now a source of sickness and death, and at a reasonable cost, may be given all the comforts of city life.

*By Dr. Cary T. Hutchinson.*—The letter from Mr. George Westinghouse calling attention to the great advantages that would accrue to the citizens of New York from the use of garbage as fuel, and to what he considers to be the "imperfect knowledge of the subject" shown in the engineering plans for the large power stations about to be erected on the East River, deserves some comment.

Mr. Westinghouae estimates the amount of garbage available daily in New York city at about 500 tons. He implies that this amount of garbage, converted into gas and used in gasengines, would be sufficient to supply a material part of the output of the great power plants that he refers to. Experiments made in England based on the burning in steam boilers of 26,000 tons of ordinary city refuse show that 1 pound of such refuse will make 1 pound of steam. On this basis, assuming the best engines and electric generators, 25 pounds of refuse would be required for each unit (kilowatt hour) output of electric energy from the power plant.

Mr. Westinghouse, however, does not propose to use the refuse for making steam, but purposes converting it into fuel gas. He gives no data as to the value of the refuse used in this way, beyond the statement that "all the garbage can be converted into a fuel gas of great value." It is simple, however, to give an approximate idea of the possible limit to the efficiency of a process of this kind.

Assuming the analysis of the garbage given—that is, 20 per cent. carbon to 80 per cent. water—the maximum theoretical heating value of 1 pound of refuse is very approximately 2,000 thermal units; if all this energy can be recovered in the form of a gas—that is to say, if the efficiency of the energy conversion from refuse to gas is perfect, and assuming a ratio of 20 per cent. between the energy in the form of electricity and the theoretical energy of the gas—a high figure—it would require 8.5 pounds of refuse per unit (kilowatt hour) of electric energy. This figure fixes the maximum theoretical duty of a pound of such refuse when converted into a gas and used in a gas engine. It is not probable that the actual commercial duty of the process will equal 15 pounds of refuse per kilowatt hour.

That is, a consideration of the elementary principles involved shows a probable duly of 15 pounds of refuse per unit (kilowatt hour) in comparison with 25 pounds, deduced from extensive tests on steam. This difference represents the possible improvement due to the use of gas engines.

Assuming then that a unit of electric energy can be obtained from 15 pounds of refuse, the 500 tons would yield about 67,000 units. As Mr. Westinghouse truly says, the aggregate power of the large steam plants mentioned is approximately 375,000 horse power. The daily output of these plants will be approximately 2,500,000 units; in other words, the maximum result that could be got from the consumption of all the garbage of New York city in the way that Mr. Westinghouse describes, would supply about 2½ per cent. of the daily output of power from these stations alone. This is so trifling that it is hardly worth consideration, not being even sufficient to drive the pumps and auxiliary apparatus in the various power houses.

Looked at from another point of view, the daily demand for power from these stations will call for the consumption of nearly 3,500 tons of the best coal. Mr. Westinghouse proposes to use 500 tons of refuse to do the work of 3,500 tons of good coal.

## The Growing Necessity of Supplementing Water Power with Steam Plants.

*Iron Age* says that owing to the unusually protracted period of drought the water power streams, especially those in the Eastern portion of the country, have been reduced to a very low and inefficient stage. This has occasioned considerable apprehension among the manufacturers whose plants are dependent upon these streams for their power. In some instances it has already proved a source of trouble and annoyance, which is emphasized by the fact that this is a most busy period and that it is essential to operate the plants to their very limit in order to produce the materials required in consumptive channels.

Throughout the New England States, where water power is largely depended upon, the streams are almost dry. In these sections during a dry season water is prized more highly than the average manufacturer values his coal. In order to secure as much protection as possible against shortage during a dry season there are built, in connection with the general systems, what are known as "storm water dams." These dams are built up the river above the main dam and they create reservoirs which are drawn from when a shortage at the main dam necessitates it. These reservoirs or reserve supplies are now practically exhausted and the mill operator is looking toward the future for relief of some kind. As a rule, the melting of the early snow is looked forward to as relief prior to the spring showers. But it is now getting down toward the middle of January and the snow fall thus far has been of almost no practical consequence. It is felt that unless there will be some exceptionally heavy snow storms before the close of this winter or unusually heavy rains there will be a water famine next summer which will greatly hamper the mills throughout the year. During the months of December, January, February and a portion of March, when the ground is frozen, a very large percentage of the rain fall or snow melt goes directly into the streams, as the hard surface prevents absorption into the ground. During the spring and summer months this condition is reversed, and owing to the absorption into the earth very little of the water finds its way to the streams or toward the turbines or water wheels.

Thus it will be seen that, while the present supply of water is at its lowest stage, the shortage next summer will be enormous, provided there is no immediate relief.

Several manufacturers have already availed themselves of the precaution of installing auxiliary steam plants to the full capacity of their factories. In so doing they have been led to detect many losses which their water power systems incur and which they had not dreamed of before taking up the matter of steam power. The investigations have brought to light the fact that the loss of time caused by the failure in power at various dry periods amounts to no inconsiderable item. We are informed that a number of the largest users of water power are now

investigating this matter, and there is much talk of putting in extensive steam plants in addition to the present water systems. It is claimed that, figuring the interest on the steam plants while idle, the ability to run the plants continuously, regardless of the water supply, more than compensates for the expenditure.

Interesting legal questions have also been raised lately in connection with the water power problem. The law allows the use of water for power purposes provided it is returned to the stream from which it is taken. It does not state, however, just when this water shall be returned. Several electric lighting concerns have taken advantage of this during the present dry season, much to the chagrin of the manufacturers "down the river." Their method is to dam the water and store it during the day, when their requirements are exceedingly light. At night, when their real work begins, they open up the dams and get the benefit of their day's storage. In this way they hold the water in check during the hours when the ordinary manufacturers need it for power and release it or put it back into the stream when most inopportune for the use of the manufacturers on the stream below them.

Charles A. Hague, consulting engineer, of 39 Cortlandt street, New York, has been dealing with problems of water power to a considerable extent of late and has encountered problems similar to those referred to. When interviewed on the subject he said :

"I have a case now on hand in which I was called in at first to survey the old dam and consider the feasibility of building a new one just below the old, as it seemed to be in a precarious condition. As the plant was operated exclusively by water power and as it would be necessary to shut down the mill during the period consumed in rebuilding the present dam, the idea of repairing the dam was out of the question. So a suitable place was selected and it was practically decided to build an entire new dam in addition to the old. The parties were willing to go ahead on this plan. But after looking over the ground it occurred to me that this was a first class opportunity for the installation of a steam plant auxiliary to the hydraulic plant. In talking this over with the General Manager and the Board of Directors we discovered that they had lost much more time through low water and inefficiency of the service than they had ever before realized. After making preliminary plans it became evident that it would be a good move to put in a complete steam plant capable of carrying the full load. This being installed the old dam could be demolished and a new one built on the same site at a considerable saving of expense over the addition of an entirely new one. This would also give an opportunity for overhauling the water wheel outfit, which was sadly in need of alteration and repair and which sooner or later would have to be completely rebuilt. This would necessitate shutting down the plant during the busy and profitable season. This installation of the steam plant will go a long way toward relieving its owners of the anxiety of a dry season, and any trouble up the stream cannot affect the working of the mill. Under such conditions a steam plant also represents the sinews of war to the water power concern possessing it, placing them in a better position and condition for fighting for their water rights when they are made to feel that their factory may possibly lose time from annoyances caused by water power users further up the stream.

"Another case which presents several interesting problems is one in which the present dam is old and decripit. The water this season is very low. In fact, it has been extremely low on numerous occasions during the last ten years, notably in 1895. In this instance the invest ment of a complete steam plant able to carry the necessary load would mean the outlay of many thousands of dollars. But even if the present dam should be thoroughly replaced without the adding of a steam plant it is now apparent that storm dams will have to be built further up the stream in order to hold the water in reserve. The question is whether it would prove a better investment to build these storm dams or reservoirs or to install a steam plant. In either event the new dam would have to be built. The water storage system would entail the stoppage of the works for 90 days. This could be done by waiting until the present rush of business has subsided. These people have a large export trade which is very steady and uniform. Therefore if they decide to shut down they must stock up in order to hold their export business. The matter is now being considered and I think that after it is all boiled down they will decide that it is most economical to install the steam plant.

"Besides the point of economy it is evident that they can best cope with their work with a steam plant as an alternate to the hydraulic system.

"An automatic steam engine working in connection with the power furnishes very steady and perfect power for the reason that all attempt at fluctuation by the water wheel, as the demand for power varies, will be promptly met in a very natural manner by the steam engine. There are no doubt plants running to-day exclusively by water power in which sudden calls for power slow down the water wheel for a few minutes, which often repeated makes a very considerable aggregate loss of speed and product in the mill or factory. This is precisely the gap which would be filled by an automatic steam engine of sufficient size to supply the balance of power.

"Present conditions existing both in the business situation and in sources of water supply indicate that many concerns now relying entirely on their water wheels will be forced to add steam plants to guard against a possible necessity of shutting down their works.

"The greatest trouble thus far has of course been experienced by manufacturers of paper. They have heretofore relied not only on water for power purposes, but require so much of it in the process of manufacture."

## The Durability of Paint.

[By Mr. H. C. Standage, in "The Builder," London, Eng.]

This subject is one of very great importance to all users of paint, whether it be the house decorator, coach painter or sign painter, and before the question of how durable a paint can be considered, there are a great many points to be taken into account. Thus, we must first of all consider the nature of the components of the paint ; for, needless to say, although all paints are compounded mechanically in the same way, and, as a general rule, with the same vehicles and driers, yet the nature of the pigment (*i. e.*, coloring) matter has to be considered because no intelligent explanation of the physical and chemical changes in a paint can be given until the nature of the pigmentary component is considered; this is so, because pigments are so very diverse in their chemical composition, some being oxides of metals, others carbonates, others sulphates, chromates, arsenates, silicates, etc., while some few are of animal and others of vegetable origin. Now, it will be conceded that it is impossible to make such diverse materials produce always a uniform compound (chemically considered). Next to knowing the nature of the pigmentary components, we have to consider the physical influences to which paint is exposed before we can fully explain its permanence or durability. Let us just reflect for a moment on what these influences are. Whether the surface that is painted be an interior or exterior one, there is always a certain amount of dust and gritty particles floating or being blown about in the air. On exterior surfaces such gritty particles as sand, etc., play a very destructive part in the wearing away of paint, because they scratch the paint, and so, by abrasion, wear it away, and, at the same time, by cutting furrows in the hard exterior surface of the coat of paint, allow moisture and deleterious gases to reach the still soft interior portion of the coat of paint. This scratching of the surface of paint is a mechanical influence, and it is more destructive on a hard coat of paint than on a soft and, therefore, elastic one. To guard against this destructive influence there is very little remedy. The only feasible one is to make the paint one that will be as elastic as possible. To produce such an elastic one, as little driers as possible should be used, and instead of a boiled oil being used as the vehicle in which to grind up the pigment, an oleo-resinous medium should be used, or else linseed oil varnish be the sole vehicle. Such fluid will allow the coat of paint to become gradually solid throughout its depth at a uniform rate, and dry to a homogeneous electric mass. On interior surfaces, of course, such mechanical abrasion of the surface of paint would not occur to such a great extent, but there must be another destructive influence, viz., dirt and dust clinging to the surface, and to effect the removal of such dirt the paint is frequently cleaned. If the cleaning be effected by merely dusting the paint with a dusting brush or cloth, there is then a certain amount of friction, and consequent mechanical abrasion of the paint; while if the paint be cleaned by washing with soap and water, and possibly soda and water, there are other destructive influences set to work to reduce the permanence of the paint. The influences in this case are chemical ones, because the cleansing fluid is of an alkaline nature. Now alkalies will set up decomposition to both paint and varnish, because an alkali will convert the oil vehicles of a paint into a saponaceous compound, and in the case of a paint, the alkali will unite with the resinous component of the varnish to form a resin. These facts are easily verified. Thus, melt a little soda in water and pour this alkaline fluid into linseed oil ; you will find that the mixture forms a soap, which is soluble in water. Again, cut up some common soap and dissolve it in a little water by boiling it therein, and when the soap has dissolved, you will be able to mix either linseed oil, turpentine, paraffine or water with such soap water—in other words, the soapy mass forms a ready menstruum

which will unite with any of these fluids. Yet again, dissolve some soda in water and boil some resin—copal, amber, sandarac or common resin (colophony)—in the alkaline fluid; you will find that the resin unites with the alkali and forms a new compound—which, in fact, is called a resinate. If you collect this resinate in a filter, you will be able to dissolve it in either water, spirit, oil or turpentine.

Now, from these facts we can understand why it is that when a coat of paint has been washed a few times it shows signs of wearing off, so much so, in fact, that a coat of paint can be made so attenuated that you will eventually reach the primary coat; then we see that the washing of a coat of paint is a chemico physical destructive influence.

Apart from this chemical disintegration of a coat of paint or varnish by washing it, there is also another destructive influence engendered, viz., the penetration of moisture through the paint to the surface beneath; and if the surface be an absorbent one, then moisture will be absorbed beneath the surface of the paint and thereby become a source of destruction. In this way the absorbed water will be gathered up beneath the paint in patches if the paint be subjected to the influence of heat, and as this confined water cannot escape through the paint, it will cause the paint to swell or bulge out from the material in which it is laid, and so cause blisters in the coat of paint. The water in these blisters, when it becomes saturated into the pores of the wood, will leave the bulged up paint detached from the material on which it is laid. At a subsequent date, as these bulged up patches of paint dry, they will become brittle, and then fall off, leaving exposed bare patches of wood beneath.

If the surface of the paint be at all crusted, the absorption of water is very great; but it is not necessary for the paint to be crusted in the least, as the oil vehicle of paint is not waterproof, but it readily allows the impenetration of water. On this point a well known American expert on painting materials[1] made the following experiment—to quote his own words: "We made some experiments by covering pieces of glass with ordinary linseed oil, and allowed them to dry and harden for a couple of weeks; these coated glasses then had water placed upon them, and were covered so that the water would not evaporate. To our astonishment, when we examined the glasses the next morning, we found that the dried linseed oil had soaked up water, and wherever the water had touched it the coating presented the appearance of a shrivelled-up apple. On allowing the water to evaporate, the coating dried down again to its place, but it is quite evident that the dried linseed oil did not repel water, and that under the action of the water disintegration was taking place. Dried linseed oil containing pigment is a different matter, as will be explained later on, and it is also possible that, as this progresses, dried linseed oil may so change chemically that it is less acted on by water.

"Our experiments do not give definite proof on this point, but we are very strongly convinced that the action of water is, all things considered, the most potent cause of the deterioration and destruction of paints. Indeed, we have already made some study on the question of rendering the paint waterproof, and we know of others who have spent a great deal of time in trying to develop a waterproof coating to go over paints and varnishes. Our belief is that if any good paint could be rendered absolutely waterproof its durability both in protecting the surface and in appearance would be more than doubled; and we do not at the moment know of any field in which the reward would be more sure and abundant than for some simple device which would render paints incapable of being acted on by water.

"Our belief as to the destructive action of water on paint is so strong that we use a water test as a quick method of arriving at the durability of any proposed mixture. * * * After looking over all the possible causes of deterioration, as above described, we decided that water alone was the chief single cause; and, as said above, if a proposed paint or mixture does not stand under water, we regard it as inferior. We really know of no single quick test so good as simply to expose the paint to water for a few hours. It is not at all strange to find, as the result of such a test, both changes in the shade of the pigment and changes in the integrity of the paint."

The above words were printed nearly ten years ago, and what conclusion the writer of this has come to by now it is impossible to say, but according to recent experience with paint, and experiments with ditto, the cause of linseed oil being permeable to water is due to the elimination of glycerine in the oil as it dries. This linseed oil consists chiefly of three fatty acids and a peculiar base glycerine, and by oxygen combining with these fatty acids the oil becomes oxidized into linoxide, while the base glycerine is expelled. Now as glycerine is soluble in water in all proportions, it will be conceivable that linseed oil, during its drying process, consists of partially oxidized fatty acids and this water absorbing glycerine, consequently the drying linseed oil does not present a perfectly water repelling film, but one that is permeated with water imbibing components, and thus the vehicle of drying oil is pierced with holes, so to speak, where the non-drying glycerine particles lie. This fact appears to have been unknown to Dr. Dudley, for throughout his writings on the subject of paint, the writer has failed to notice any reference to it.

The following chemical equation will explain the action of the expulsion of glycerine from the linseed oil during the process of its drying (that is, in correct words, the oxidation of the fatty acids or conversion into linoxide).

When an oxide is added to a fatty (not hydrocarbon) oil, the oxide combines with the fatty acids to form an oleate of the metallic base of the oxide, and glycerine is produced, *e. g.:*

The chemical formula of olein (one of the fatty acids of both linseed oil and olive oil) is $C_3 H_5 3C_{18} H_{33} O_2$; while the chemical formula of sodium hydroxide is NaOH.

Now, when these two bodies are mixed together the following reaction occurs:

$$C_3 H_5 3C_{18} H_{33}O_2 + 3Na\,O\,H = 3NaC_{18} H_{33} O_2 + C_3 H_5 (O H)_3.$$

Sodium oleate. Glycerine. (Soap.)

If instead of sodium hydroxide (*i. e.*, soda lye, which is only used in soap making) we mix an oxide of a metal with linseed oil, a similar reaction occurs, but of course the oleate produced is the oleate of the metal forming the base of the oxide; thus if it be red oxide of iron pigment, the oleate is an oleate of iron; if the oxide be of lead—as red lead or litharge—then the oleate is of lead, a lead soap, and so on. Now some of these metallic oleates or soaps are soluble in water—particularly so those of lead—and others not readily soluble, but are of a non-drying or pulverulent nature. Such, for example, as that produced by mixing zinc-white with linseed oil.

Now, every one knows that common washing soaps are soluble in water, and that as they dissolve a large amount of froth or scum is produced, but every one does not know that such froth or scum is due to the presence of resin in the soap, yet such is the case. Soapmakers, to increase the weight of the soap at a cheap rate, add what they call a "filler" to the soap mass produced by the union of the lye, and oil or fat; such filler is either common resin, fuller's earth, lime, or some other cheap body which will form a scum when the soap is rubbed up with water. In this we see the resin (which in this case has become a resinate by its combination with the soda lye) is also a body soluble in water. From this fact it is easy to understand how it is that a coat of paint or varnish after being washed with soap and water, or soda and water, a few times will gradually wear away and become attenuated. Yet another cause of want of durability in a paint is its liability to peel off. Dr. Dudley, on this point, says: "It is well recognized that in certain places paints do not adhere well to the surfaces, and it is also well recognized that some paints do not adhere as well as others. This is a marked characteristic, so far as our experience goes, of white zinc, namely, that it peels. We have never noticed any other pigment which possesses this property in any marked degree. It is difficult to say why this pigment should peel so badly. The most plausible theory which we have ever run across is that the zinc white combines with the oil used in the paint forming a species of zinc soap, and the zinc soap we know to be a brittle, non-adhesive substance. We do not think this theory has ever been definitely established by experiment, and give it for what it is worth." As we have already mentioned, Dr. Dudley apparently was unacquainted with the chemical reaction that occurs between pigment and the constituents of fixed oils; the equation given above fully explains the cause of such brittleness. Every painter knows that a mixture of red lead and linseed oil forms a solid putty, which eventually becomes insoluble in water, but such compound although hard is not very brittle. A similar mixture of zinc white and linseed oil however would form a brittle mass that could easily be pulverized.

Some reader may ask how is it that, if oleate of lead or lead soaps are soluble in water, that this mixture of red lead and oil is insoluble in that fluid? The answer is this: Red lead, which is an oxide of lead, not only combines with the fatty oil acids of the linseed oil, but at the same time also combines with the glycerine that has been eliminated from the oil, and thus a solid mass is produced of a mixture of red lead and glycerine; as if litharge and glycerine be made, you will find that a very useful cement is produced by such mixture. Now, it is easy to see that if the compound formed by pigment and vehicle is of a brittle, pulverulent nature, that it will not possess much adhesiveness, but be

1. Dr. C. B. Dudley, Chemist to an American Railway Company.

readily brushed or shaken off the surface on which it is laid as soon as the elasticity of the oil is lost by the drying of the oil; hence the peeling of the paint.

Another point concerning the peeling or non-adhesion of a paint to a particular surface is given in the cases of painting galvanized iron and of zinc. It is not every kind of paint that will adhere to such material. This in the case of the galvanized iron is probably due to galvanic current set up by the action of the fatty acids on the iron and zinc with which it is galvanized, but in the case of zinc such electric current cannot be supposed to exist, as there is only one kind of metal present. The writer's investigations on this point have so far not provided sufficiently tangible proof to attempt to offer an explanation on the cause of such non-adherence. Possibly the non adherence is due to the glycerine which is eliminated from the oil vehicle being driven to the under surface of the paint, and as the zinc is non-absorbent the coat of paint cannot, owing to the layer of glycerine beneath it, become adherent to the zinc surface. Still another deleterious influence that destroys the durability of a paint is the action of noxious gases on the paint; such influence is a chemical one. Sulphur is a substance which readily combines with lead salts to form a new compound, therefore, the action of gases in which sulphur is a component, such as sulphuric acid gas, is precisely the same as mixing lead salts and sulphur together. In the case of a paint the oil vehicle protects the lead pigment from actual contact with the sulphuric fumes for some time, but as we have already said, the oil vehicle is not waterproof, therefore the combination of the sulphurous fumes with the glycerine and water that is in the paint would produce sulphuric acid, and this acid in the paint would react on the lead pigment of the paint and form sulphide of lead, which is black or brownish. Every painter knows how dark a coat of white lead paint will become after exposure to the air for some time, whether the exposure be in the interior or the exterior of a dwelling. The darkening to a dirty drab hue is simply due to this cause. Another destructive influence of deleterious gases is the action of ammonia gas. This gas is of an alkaline nature, and thereby it, to a small extent, disintegrates the oil or varnish vehicle of a paint, whereby a further decomposition of the paint can occur.

The influence of light on paint has been demonstrated to be one of a destructive nature as regards some pigments, chiefly those of an organic origin, and those which owe their color to the presence of an aniline dye. It has been demonstrated by experts that the destructive action of light is chiefly due to the presence of moisture; in dry air the destructive element is very feeble. The actual kind of destructiveness is a weakening or fading of the tone of color of the pigments. As we have already shown that moisture is present in a paint (due to the presence of the glycerine and the absorption of water by the glycerine) it is easy to understand that fierce sunlight will cause a bleaching or fading of tone. The influence of light is a physical one, but it is conceivable that some physical action may set up a chemical one in the paint components. Yet another cause of want of durability in a paint is due to the nature of the material on which the paint is laid, if it be absorbent much of the oil vehicle in the paint may be absorbed if the material be not properly primed. In other cases the material which is painted may be a non-absorbent one, and in other ways the material and paint may be antagonistic to each other, but cases can only be dealt with locally by the painter himself who alone can best know what is the right kind of paint to employ.

The final destructive influence in the durability of paint is that of chemical action, but chemical reaction is too intricate to deal with in this paper, and requires a separate paper to itself.

## Carbonic Oxide Absorbed by Plants.

In his presidential address, delivered before the British Association, Mr. Horace Brown gives an account of the experiments which he has carried out in order to determine the conditions under which the carbonic oxide of the atmosphere is absorbed by the leaves of plants. He finds that the surface of the leaves absorbs the carbonic oxide at about one-half the rate at which the same gas would be absorbed by an equal surface kept constantly wet with a solution of caustic alkali. He considers that the gas penetrates only by the mouths or pores of the leaf, these occupying a relatively small proportion of the surface. He makes some calculations as to the rate of speed with which the carbonic oxide passes through the pores, and finds that in the case of the plant under consideration, a variety of the catalpa, the gas must pass at the rate of 150 inches per minute. To imitate the action which takes place in the leaf of the plant, he has carried out a series of experiments, using a recipient containing an alkaline solution, and provided with openings of various diameters. In this way the speed of penetration of the carbonic oxide is found to increase very rapidly, as the diameter of the aperture is lessened, and for minute opening this speed is necessarily very great. Mr. Brown has also made determinations to find out what proportion of the solar energy is utilized for the vital processes of the plant. This proportion is much greater in diffused light than when the leaf is exposed to the direct light of the sun. In the former case he estimates that 95 per cent. of the energy absorbed may be utilized; of this 2.7 per cent. represents the work of assimilation and the remainder is used for evaporation of the water contained in the leaf. In the second case, that of exposure to direct sunlight, only 28 per cent. of the energy was utilized, and for the work of assimilation but ½ per cent. Among other calculations, he estimated that 6.5 per cent. of the total energy of solar radiation consists of rays which are capable of being absorbed by the chlorophyl of the leaf.

[From *Electricity*. Part III.]

## The Future of Electric Illumination.[1]

By Mr. Jean Wetmore.

The wrong tendencies of Underwriters' rules and lack of backbone on the part of insulated wire manufacturers have not been the only ills that electric illumination has fallen heir to, or the only causes of expensive and involved construction.

The lowering of the grade of these necessary adjuncts called for more complicated and expensive additions as supernumeraries to guard against the evils that resulted. The cure was found in the old homeopathic maxim, *similia similibus;* thus another evil was indicated to counteract the first cure. Poison with poison that was the idea, for when the degenerate insulations failed to insulate it was found an expensive and troublesome undertaking to repair them, so the birth of another idea occurred as a nightmare to cheap construction—it was an asphalted paper tube to be buried in the walls. The architects became enthusiastic over the idea of being able to replace defective insulation with little trouble, as well as to be able to draw in wires at any time after the completion of a building. Such constructions possessed the additional advantage of wiring suburban structures at a future time when there should be an extension of the electric mains.

The manufacturers of this new product claimed that their paper tubes were sufficient insulation of themselves, and that simple cotton covered wires and even bare wires could be used in this wonderful tube with absolute safety. These tubes were fireproof, of course, and salesmen made demonstrations that convinced the unsophisticated; but one of the foremost installations, the Edison Building on Broad street in this city, had its paper tube conduits burned out through imperfectly insulated wires and the fire was carried from floor to floor as through an elevator shaft, and thus the city came nearly losing another one of its fire-proof structures.

These tubes were claimed to be waterproof, but it was early discovered in a Pittsburg building that water soaked them through and through, and when the old wires were withdrawn the tubes pulled apart and the patience of a Job could not thread new ones through them again.

These conduits were loudly heralded as proof against lime, and yet an installation in the Edison station at Milwaukee soon proved that vestiges of them only remained when the plaster was removed.

They were also claimed to be rat and mice proof, but these animals found them, when seeking runaways, easier to destroy than the concrete and iron construction.

It was also found that moisture condensed within, when the warm atmosphere circulated through them from without.

So defective were they found at last that the promoters of these shams finally declared that bare and cotton covered wires could not be recommended as at first proposed, and two wires in one duct were prohibited, while the best insulation was declared to be none too good for the contained wires in these highly vaunted acid, rat, moisture and lime-proof cure-alls, for cheaply insulated conductor diseases, and so rubber insulation became again in use, but at this junction, after the hard competitive struggle for recognition, aided by the undiscriminating Underwriters' rules, there were no longer any best insulated wires.

Soon these tubes were discovered to be of little protection to the contained wires from the hammer, nails and saws of the workmen, so another "improvement" was made by wrapping an "armor" of thin metal about the tubes; but still nails, hammers and saws encountered no perceptible difficulties in producing mechanical injury, so another

1. *Ante*, p. 130.

improvement was inaugurated by drawing the tubes through heavy gas piping; thus the cost of installations was further increased and the equipment of buildings with electric lights became more of an expensive luxury, and the "lag" when alternating currents were used came to be considered detrimental.

At this stage these ideas became so serious that some sensible electricians proposed to do away with paper tubes entirely, by placing the insulation where they considered it belonged, around and on the wire directly and to make it of durable high grade quality and then use plain iron pipes for the sole purpose of mechanical protection.

There have been no class of people so stubborn to electrical common sense construction and so readily carried away with foolish and expensive innovations as architects and our friends in the various underwriting departments.

To their methods of protecting themselves against the poorer class of insulations and giving no advantage or protection to manufacturers of high grade materials, we owe mainly the many mistakes, failures and the great expense of electric equipments as compared with gas.

[To be Continued.]

## SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, Jan. 10, 1900.

*Coal and Labor Troubles.—The Manchester City Council and Their Late Engineer of the Gas Department —Explosion at Douglas Gas Works —Carbide of Calcium.*

The new century, as some call it, or the last year of the old century, as others prefer to style it, has not made a comfortable opening as far as managers of gas works are concerned. The Christmas season of 1899 1900 has been more harassing than usual from more than one cause. December opened with mild weather, and everything seemed to point to a somewhat slow, dull time, similar to that experienced during the last three or four seasons. But the second week in that month was attended with cold, frosty weather and some snow, which at once had the effect of increasing the consumption of gas from 10 to 20 per cent. This, under most circumstances, would be hailed with gladness, but it came at a time when few were prepared for any extra strain. Owing to difficulties with the railway companies, deliveries of coal had been short for some time, the usual excuse being difficulty in obtaining trucks. Why there should be a shortage of trucks, however, is not at all apparent. The increased demand, coming upon low stocks, and followed immediately by the Christmas vacation at the mines, has had the effect of creating a coal panic, and for a few days it was more a question of where to get coal, than of the price to be paid for it. In several cases it has been impossible to maintain a proper supply of gas; one or two districts have actually been in darkness, and others are issuing notices asking that the consumption of gas may be reduced as much as possible. As usual, all sorts of theories have been put forward to account for this state of things, and blame has been dealt out unsparingly to each and all concerned. But the real explanation of the matter is very simple. I have previously pointed out that stocks are kept low at the collieries, and the sudden, increased demand, aggravated by the Christmas vacation, is at the bottom of it all. The lesson to be learned is that the 1st of December should find every gas works holding sufficient stock to carry operations well into January without further supplies.

Gas works depend not only upon coal but also upon a liberal supply of unskilled labor. Various things have combined to upset the labor market. Gas works have always been looked upon as affording employment for army reserve men, and many of these have been called upon to rejoin the colors on account of the war. Trade generally is good, and there is a plentiful demand for labor in all directions, so that there is difficulty in getting sufficient "hands." The excitement of seeing friends off to the front has increased the temptations to give way to drink, so there is trouble not only in respect to the quantity, but also as to the quality of labor available. Some gas managers were compelled, during the holidays, to damp down furnaces for the simple reason that they could not get men enough to work them. The difficulties in this instance were also accelerated by the increased demand before Christmas which had the effect of running the gasholders down. Fortunately a change of weather followed hard upon Christmas day, and the holiday season was marked by a spring rather than a winter climate, affording a welcome opportunity for increasing stocks of gas. Those who were not hindered, either by the coal or the labor market, from maintaining full working, were able to make good use of the time, but many, on account of the causes above indicated, were unable to do so, and have to face the January business without being properly fortified to meet it. There has been a disposition of late, on account of the advances in the cost of materials, to stave off necessary extensions of plant, and mild winter seasons have enabled this to be done without special inconvenience. But the experiences of December, 1899, have proved a rude awakening, and it is evident, not only that the days of small coal stores have departed, but that the necessity for ample storage capacity is, if anything, more pressing than it was before.

It is an ill wind that blows nobody any good, and the makers of water gas apparatus, and of retort house machinery may be expected to be busy in the spring. Many who had never been personally brought face to face with the necessity for these modern accessories will now be more favorably inclined to consider the question of generators, oil tanks and labor saving appliances. The high prices of metals, too, will tend to diminish conservative tendencies in the matter of extensions, and instead of simply following the old lines, the merits of every available system, even if quite novel, will be carefully compared together.

The Manchester City Council have taken action in respect to the widow and family of the late Mr. G. Ernest Stevenson in a gentlemanly, honorable way. The minutes of the Gas Committee included a resolution to the effect that £5,000 be granted for the benefit of the widow and family, in settlement of all claims against the Council, to be invested in the names of trustees, and the interest paid to Mrs. Stevenson until her death or re marriage, when the money shall be divided amongst the children. Mr. Alderman Gibson, in moving the adoption of the minutes, enhanced the value of the grant by the tasteful and well chosen language in which he referred to the work done by the late chief engineer. About £500,000 had been spent in extensions during the last five years, from designs and specifications prepared by Mr. Stevenson. He did not care to inquire as to the legal position of the Council in the matter, or what sum a jury would be likely to award, but preferred to deal with the matter from a moral point of view and to ask what a prosperous committee of a wealthy corporation might be expected to do under the circumstances. His remarks were received with strong expressions of approval, and the minutes were passed. The Manchester City Council will not lose by this action. The knowledge that they are prepared to make ample compensation for personal injuries sustained in their service will tend to encourage and stimulate all the officials in the performance of their duties. A good master does not necessarily insure a good workman, but goes a long way in that direction.

A sad accident at the Douglas gas works, Isle of Man, which occurred on the 21st ult., and resulted in the loss of three men, exemplifies the already fairly known fact that explosive gases are apt to accumulate in the vacant space above the liquid, in tar or liquor wells. Two 40-feet gasholder tanks, each 14 feet deep, having been thrown out of use by the erection of larger gasholders, have been converted into tar and liquor tanks respectively, according to the usual custom. They were well situated for such a purpose, being well away from the retorts and purifiers. As usual the scrubber and washer were erected in the near vicinity. The tanks were not ventilated in any special way. A new pump was being fixed, and in order to complete operations before Christmas, the men were working after dark and using a naked lamp. This was brought near to one of the manholes, and fired the gases in the liquor well. The explosion not only ruined the brick arches which formed a roof or covering to the well but also brought down the tower scrubber and the washer. The three workmen engaged at the pump were crushed in the wreckage. The manufacture of gas was stopped, and as a new connection to the purifiers could not be got together and put down at once, there was a short supply to the district for a day or two.

An inquiry of the usual character was held as to the cause of the decease of the three men, and the summing up by the Crown was remarkable for a decided bias against the Gas Company. Although it was proved that all the workmen had been cautioned against the use of naked lights and that such use was expressly forbidden, he held that was not enough, and that notice should be put up. Legal authorities as a rule have more faith in the awe inspiring properties of "posters" than practical men. Then he quarrelled with the fact that the manager of the works had gone to tea at the time, and argued that it was the duty of the manager to see that all regulations were carried out during his absence. Gas managers have a right to meal times as well as other men, but even if they are at the works continually they cannot be everywhere at once, and certainly cannot be blamed for the

consequences of wilful disobedience. This was not an emergency job, and there was no reason why the manager should know that the men were working at the pump. The jury returned a verdict to the effect that the deaths were caused by an explosion, due to the careless use of a naked light in the tar yard. They recommended that notices should be prominently posted as to the danger of naked lights, and that the tanks should be ventilated by shafts carried a sufficient distance into the air to avoid risk. There is no Workmen's Compensation Act in the Island, so possibly the attitude taken by the Crown was adopted in the interests of the wives and families of the deceased.

There are two sides to the question of ventilating tar wells, as to most others. Many engineers prefer simple manholes to ventilating shafts, not as a means of saving expense, but to avoid nuisance. People who live in the neighborhood of gas works have noses, and these useful organs are like that of the fool in Shakespeare's "Tempest," apt to be "much offended." So it does not seem worth while to risk a constant nuisance, in order to provide against such an improbable occurrence as a naked light being brought within a foot of the open manhole. It is also by no means certain that the natural draught of a shaft would insure sufficient ventilation. The explosive vapors that accumulate on the surface of ammoniacal liquor are heavier than air, and could only be efficiently removed by artificial suction. Rightly or wrongly many believe that a closed well is as safe as one fitted with so called ventilating shafts.

A peculiar accident has occurred in connection with the manufacture of carbide of calcium in the works of the Aluminum Company, Foyers, Inverness. A charge of powdered coke and lime was under treatment in the usual way, when the armature conveying the electric current to the upper portion of the charge suddenly gave way and fell into the molten material. The effect of the sudden drop of a mass of iron weighing 15 cwt., was to burst open the furnace doors and force out the highly heated and glowing contents upon the floor. Nine of the workmen were injured, two seriously, and one has since died. So there are evidently risks and dangers attendant upon the use of the electric furnace. A recent return sets forth that, whereas there were 51 places where carbide of calcium works were either in operation or in course of erection, at the end of 1898, there are now 93, of which 76 are actually running. Of these France claims 21 and Switzerland 11. Austria Germany and Italy have 23, but the United States only 6, and the British Isles 4. It would be interesting to know the sources of the necessary carbon in places where coal is costly, and it appears from the above figures that the system is making the most progress in localities where coal is dear.

## ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At the annual meeting of the Lincoln (Neb.) Gas Company the officers chosen were: Directors, D. E. Thompson, C. O. Whedon, I. M. Raymond, Florence Putnam and J. K. Honeywell; President, D. E. Thompson; Vice-President, C. O. Whedon; Secretary and Treasurer, J. K. Honeywell.

For the following interesting chapters referring to the standing of the suit brought by the Spokane Falls (Wash.) Gas Light Company against the Spokane Street Railway Company, for damages wrought by electrolysis to the mains of plaintiff, we are indebted to Mr. W. A. Aldrich, Secretary and Manager of the Gas Light Company. He writes under date of the 13th inst., and says:

To the Editors American Gas Light Journal: Herewith I enclose a copy of the judgment handed down by the Superior Court of Washington, for the County of Spokane, in the case of the Spokane Falls Gas Light Company *vs.* the Spokane Street Railway Company. The judgment is very satisfactory except in one matter, namely: We insist that the double trolley system is the only preventive against electrolysis. The other side has made several propositions with a view to a compromise, but as this question must be settled, sooner or later—and the sooner the better—we will press the case to the final issue. This Company will appeal on the double trolley contention. In view of the increasing damage going on in all parts of the country, we are sanguine that we will entirely succeed.

The inclosure referred to by Mr. Aldrich is as follows: "Spokane Falls Gas Light Company, Plaintiff, vs. Spokane Railway Company, Defendant.—Decree.—Now, on this 29th day of September, 1899, this cause came regularly on for hearing upon application of plaintiff for a decree based upon the findings of fact and conclusions of law heretofore signed, and the parties being present by their respective attorneys, and the Court being fully advised in the premises, it is hereby ordered, decreed and adjudged as follows:

"1st. That from and after the 1st day of April, A D., 1900, said defendant shall cease to run, manage or operate, or cause to be run, managed or operated, any line or lines of electric street railway, or cars along same, in the city of Spokane, except as follows:

"(a) In streets where the ends of the car rails are mechanically and electrically connected with cast welded joints, provided that cast-welded joints need not be used in any streets except where the roadbed in or upon which the car rails are laid is paved with asphalt, brick, wooden blocks, macadam or other similar material.

"(b) In streets where the roadbed is not paved with asphalt, brick, wooden blocks, macadam or other similar material, and the ends of the car rails are, or shall be, electrically connected with No. O Chicago bonds of the best and most approved make, or a bond equally good in every respect, and the affixing of the bonds to the rails is or shall be made in the most modern, efficient and approved manner.

"2d. That on or before the date last above mentioned, the defendant herein shall in all streets in which it owns, controls, or operates lines of electric railway in the City of Spokane, or may hereafter own, operate or control such lines, and in which streets the roadbed, or the material with which the street is found, is asphalt, brick, wooden blocks, macadam, or other similar material, connect the ends of its rails with cast welded joints, and in all other streets in said city in which defendant owns, operates, or controls, or shall hereafter own, operate, or control, lines of electric street railways, it, said defendant, shall electrically connect the ends of its rails with Number O Chicago bonds of the best and most approved make, or a bond equally good in every respect, and keep same in proper repair, and the affixing of such bonds to the rails shall be made in the most modern, efficient and approved manner.

"3d. Defendant shall not be required to equip its car rails now on Howard street, between Riverside avenue and Front avenue, with cast-welded joints until it becomes necessary or proper to repair the bonds now affixed to said rails, unless it should sooner become necessary or proper to repair said portion of Howard street with material as specified in the last preceding paragraph of this decree.

"4th. In the event said defendant shall appeal from that portion of this decree which enjoins it from operating electric street car lines, and orders the above mentioned changes to be made, then the time herein fixed for the taking effect of said injunction, and for making said changes, shall be extended the length of time which shall intervene between the taking of such appeal and the filing in this Court of the remittur from the Supreme Court of said State.

"5th. That said plaintiff shall have and recover of and from said defendant its costs of suit, taxed at — —, and execution shall issue therefor."

"L.," writing from Portsmouth, Ohio, under date of the 22nd inst., says: "At a meeting of the stockholders of the Portsmouth Gas Company, held last week, the following named officers were elected: Directors, James T. Lynn, Eugene T. Lynch, M. B. Daly, Frank B. Kehoe and John R. Lynn; President, J. T. Lynn; Vice-President, F. B. Kehoe; Treasurer and Secretary, E. T. Lynch; Superintendent, Jno. R. Lynn. It was decided to enlarge the plant and extend the main system, which betterments it was estimated would involve an expenditure of $30,000."

At the annual meeting of the Hartford (Conn.) City Gas Light Company the Directors chosen were: John P. Harbison, James L. Howard, Hugh Harbison, F. B. Cooley, H. H. Morgan, George Roberts, Atwood Collins; Nathaniel Shipman and Henry A. Redfield. The Directors subsequently perfected the following executive organization: President, James L. Howard; Treasurer and General Manager, John P. Harbison; Secretary, Thomas Evans.

The regular dividend of 1½ per cent on the shares of the Denver (Col.) Gas and Electric Company is payable the 20th prox.

The Auburn (N. Y.) Gas Light Company has engaged handsome and suitable office quarters in the building at No. 122 Genesee street. Occupancy thereof will not occur until some time in the early spring; and, prior to taking active possession, Manager Dunning proposes to refit the store floor so that its front will show as one of the most attractive business places in the city, either day or night.

Mr. E. G. Holzer has been appointed Superintendent of the Warren County Gas Company, of Phillipsburg, N. J. He will assume complete control the 1st prox.

A BILL recently introduced in the lower branch of the New Jersey Legislature, by Mr. Bradley, provides that gas light companies may, by resolution of their Boards of Directors, and consent in writing of two-thirds of their stockholders, reduce the amount of their capital stocks, or change the par value of their shares. This is a pretty slick bill.

THE Hudson County Gas Company, of Hoboken, N. J., did a very graceful thing when it pensioned Mr. Wm. H. Havens, who has been with the Company since its chartering in 1862.

THE old plant of the Bethlehem (Pa ) Gas Company has been purchased by the proprietors of the new Bangor (Pa.) Gas Company, who will re-erect it under the supervision of Mr. Peter M. Sheler.

THE Treasurer of the Marquette (Mich.) Gas Light Company, Mr. C. H. Call, has notified the consumers that the Company is obliged to increase its selling rates in the sum of 30 cents per 1,000 cubic feet, "in order that the Company shall not furnish gas at less than cost."

AT the annual meeting of the Coldwater (Mich.) Gas Company the officers chosen were: Directors, L. E. Rose, George C. Turner, H. C. Loveridge, L. M. Wing, A. S. Upson—the latter succeeds A. L Zwisler—B. H. Calkins and F. W. Moore; President, B. H. Calkins; Vice-President, H. C. Loveridge; Treasurer, F. W. Moore; Secretary, Geo. C. Turner.

THE plant of the Newark, N. Y., Gas Light and Fuel Company will be in complete working order this week. It affords an example of speedy construction, having been constructed in something less than four months.

A CORRESPONDENT forwards the following clipping from a recent issue of the Washington (D. C.) *Post*. "The plant of the Lynchburg (Va.) Gas Light Company has been sold to F. H. Spelton (representing the Real Estate Trust Company, of Philadelphia), and R. D. Apperson, of Staunton, Va., for $161,828. The stockholders receive an advance of $80 over the par value ($100 per share) and, with the division of the surplus, will more than double the original value. The new Company guarantees to reduce the price of gas 30 per cent., the ruling rate for which is $1.75 per 1,000."

AT the annual meeting of the shareholders in the Mutual Gas Light Company, of Savannah, Ga., this result was reached: Directors, Randall Morgan, Samuel T. Bodine, A. B. Beadle, Lewis Lillie, Wm. J. Serrill, Jas. Ball, W. W. Gibbs, Edward C. Lee, Geo. S. Philler, J. A. P. Crisfield, Henry Blun, B. A. Denmark, Walton Clark, Thomas Dolan and Geo. Philler; President, Samuel T. Bodine; Treasurer, E. C. Lee; Secretary, Jno. W. Golden.

A CORRESPONDENT incloses the following report of how a Chicago man got his gas, and what happened him after his method of obtaining it was determined: "You ought to be given a medal for your honesty; any man who can get his gas for nothing, but does not take it would deserve commendation," said Judge Hutchinson recently to Frank Buckle, who was on trial before him. The prosecutor was the Peoples Gas Light and Coke Company, which alleged that Buckle, who lives at 383 Fifty-fifth street, put a device on his gas pipes so that he could use both fuel and illuminating gas without having the supply registered by the meter. The defendant has been in the employ of the Gas Company for more than 15 years, and it had been his duty to look out for those who were evading payment of their gas bills by secret devices. Inspector Mitchell of the Company said that he had visited the premises of the defendant and had shut of the supply to the meter from the street main but that the gas stove still continued to work. Buckle pleaded guilty, but when on the stand he testified that when he moved into the house the device was on the pipe, and that although he knew it was there, and knew what it was used for, he had never utilized it. This testimony brought forth the above comment from the Court. He was fined $15.

MR. THOMAS H. HINTZE, formerly Superintendent of the Malden and Melrose (Mass.) Gas Company, has been appointed Superintendent of Works for the Lowell (Mass.) Gas Company.

MR. B. S. REYNOLDS has actively assumed the duties of Secretary and Superintendent to the Clarksville (Tenn.) Gas Light Company, vice the late Mr. C. H. Carter, whose death was reported in the JOURNAL for the 25th ult.

THE acetylene gas plant which acts as a sort of central station for the artificial lighting of Salisbury and Lakeville, Conn., was destroyed by an explosion something over a fortnight ago.

THE plant of the American Gas Light Company, at Bloomsburg, Pa., is being fitted out for the manufacture of coal gas. The Patton process has heretofore been followed in Bloomsburg. The bench work has been awarded to Messrs. J. H. Gautier & Co., of Jersey City, N. J., and the iron work will be constructed by Messrs. Jas. R. Floyd's Sons of this city. The Company is said to be considering the advisability of erecting a storage holder.

AT the annual meeting of the East Saginaw (Mich.) Gas Company the officers elected were: Directors, Jno. R. Morley, William L. Webber, George Morley, H. C. Potter, Jr., and T. A. Harvey; President, John R. Morley; Vice President, T. A. Harvey; Treasurer and Secretary, John M. Morley.

THE Board of Gas and Electric Light Commissioners, of Massachusetts, have ordered that the Haverville Gas Company shall, on and after February 1st, put its selling rate at 80 cents per 1,000 cubic feet—a reduction of 20 cents per 1,000.

W. T. BRADY, of Trenton, N.J., will find the following reprint, from the Philadelphia *Times*, a suitable reply to his query of the 22nd inst.: "The Board of Directors of the United Gas Improvemenl Company have voted to increase the capital stock from $15,000,000 to $22,500,000. No explanation of the action was given, its object being held as secret as was the fact that such an increase was to be made. The news in fact was a complete surprise. Even brokers representing inside interests knew nothing of the matter until they read the advertisement in the morning's papers announcing the action of the Board. The notice of proposed increase simply read that a meeting of the shareholders will be held March 19 to vote for or against adding 150,000 shares (per value $50 each) to the capital stock; but an official of the Company stated that shareholders as usual would be given the right to subscribe at par in the proportion of 50 per cent. of their holdings. In other words, a holder of 200 shares has the privilage of taking 100 shares of the new issue. This will add $7,500,000 to the capital, bringing it up to $22,500,000. To pay 8 per cent. upon this calls for $1,800,000 annually. The profits in 1898 were $1,864,130, or $64,130 in excess of the new dividend requirements, but the net earnings for last year were greatly in excess of those of 1898. This is the second increase of capital in 2 years, the last being in May, 1898, when the capital was raised from $11,500,000 to $15,000,000."

AT the annual meeting of the Cleveland (Ohio) Gas Light and Coke Company, the officers elected were: Directors, C. H. Beardslee, M. S. Greenough, David Senton, J. H. Morley, W. J. Hayes, F. A. Sterling and C. W. Bingham; President, M. S. Greenough; Vice-President, J. H. Morley; Treasurer and Secretary, C. H Beardslee.

AT the annual meeting of the Newburyport (Mass.) Gas and Electric Company the matter of enlarging the plant was discussed at length. At the termination of the debate the proposition was referred to a Committee of the Directors. The officers chosen were: Directors, D. D. Tilton, Wm. R. Johnson, L. B. Cushing, T. C. Simpson, Samuel March, E. P. Dodge and N. N. Jones; President, William R Johnson; Treasurer and Clerk, Dudley D. Tilton.

THE Richmond (Va.) City Gas Works were operated at a profit for the past year amounting to $87,997.94. The number of meters in use, Jan. 1, 1899, was 6,736; in use Jan. 1, 1900, 7,057—a gain of 321.

THE authorities of Palmyra, N. J.. have passed an ordinance granting the River Shore Gas Company the right to lay mains and service pipes within the township limits.

FOR the half year ended December 31, 1899, the Sioux City (Iowa) Gas Light Company paid into the city treasury the sum of $1,068.17, which represents 2 per cent. on its gross receipts. The returns on electric lighting account (at a like rate) for the same period amounted to $332.91.

THE City Council, of Camden, N. J., has repealed the ordinance, passed January 12th, 1898, under which corporate life was given to the Peoples Gas Company of that city. The repeal was made on the sufficient ground that the Company had failed "to file a bond and accept the ordinance hereby repealed, or complying in any way with the terms thereof to make the same operative."

THE shareholders of the New Bedford (Mass.) Gas and Edison Light Company have agreed to the proposition to increase the capital stock in the sum of $100,000.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.
PACIFIC COAST GAS ASSOCIATION.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

*Notification Respecting Advertising.*—Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday,

AGENTS:

New York—American News Co. 39 and 41 Chambers St.
*Germany*—Lemcke & Buechner, of New York.
*England*—Aug. Siegle, 30 Lime Street, London.

MONDAY, JAN. 29, 1900.

## How Horse Power is Figured.

The horse power, the unit adopted when Boulton and Watt recognized the necessity for a large concentration of power, continues in use to-day. It was found that 33,000 foot-pounds per minute or 550 per second, represented the capabilities of a good horse. A foot-pound represents the same amount of work regardless of the manner in which it is expended.

A pound weight lifted through a foot, a pound of water caught in the bucket of a water-wheel and descending one foot, the piston of a steam engine moving through 1 foot against a resistance of 1 pound, are instances in which the expenditure of power is precisely the same. This does not imply equal horse power for the motors, for they could only be rated the same if equal work was done in the same time. Thus if the water-wheel took two seconds to expend the foot-pound while the steam engine only took one, the latter would have twice the rated power of the former—in other words, twice the power would be given out by the steam engine as that by the water wheel during the same period. For this reason, statements regarding the power of motors have no value unless accompanied by mention of the time taken to expend that power; if this be expressed in foot pounds per minute, it may readily be reduced to horse power by dividing by 33,000, or, if in seconds, by 550—as the case may be.

It was regarded necessary at the time of Watt that makers of steam engines should have a standard by which engines of different types and designed for different purposes could be compared. As the power of an engine is measured by the foot pounds of work performed in a unit of time, some standard including the various items which contribute to the power of an engine was sought for. It was obviously impossible to arrange a standard from tentatives upon the work done. A pumping engine and steam roller could not be compared by the work actually performed by each, as it is so different in each case, but by comparing those dimensions which have an influence on the performance of the engines it was possible to arrive at a standard. The piston of an engine moving to and fro travels over a certain distance in a unit of time, dependent upon the length of stroke and number of revolutions; thus if the stroke be 3 feet the number of revolutions, sixty per minute, which means 120 strokes per minute, the total distance traversed in feet is $120 \times 3 = 360$ per minute. The foot-pounds exerted during the same time are $360 \times P$ where P represents the total mean pressure of the steam acting upon the piston which is equal to the pressure per square inch multiplied by the area of the piston. These foot pounds divided by 33,000 represent the horse power of the engine for the assumed steam pressure.

There are thus four items which influence the power of the engine, two of which are fixed when the engine is built and the other two subject to change. The length of stroke and diameter of cylinder can not be altered materially, the speed is also frequently fixed by the adjustment of the governor and is stated in the maker's catalogue, but the steam pressure is subject to change and is arranged to meet local conditions. For this reason it was found necessary to establish a conventional mean steam pressure which, exerted throughout the stroke of the engine, would serve when combined with the dimensions as a measure of the power of the engine.

In the early days of the steam engine when working pressures were low, this standard pressure was set at 7 pounds per square inch, but with improvements in boilers the pressures increased, which occasioned frequent changes in the standard pressure, but even now no value has found universal acceptance among engineers, possibly owing to the rapid development of high pressures and the use of multiple expansion engines. Thus the nominal horse power of an engine, unless it be known what the makers' standard pressure is, can only be open to criticism and doubt.

By the use of the indicator applied to the engine cylinder when the engine is set up and at work it is possible to obtain accurately the exact work which the steam is doing, and incidentally to obtain information from the indicator diagram concerning the working of the valves. For large engines, marine especially, this is the only feasible means for obtaining an estimate of the power, but care should be taken to understand what the result attained by this method means. It will usually be larger than the nominal horse power, for the latter, as we have seen, assumes a mean steam pressure lower than the actual mean pressure recorded on the indicator diagram; also it will be found to exceed the actual horse power determined in the case of the pumping engine by the water lifted from the depths of the mine. This apparent discrepancy is due to engine and pump friction, which the indicator includes in the total work done by the steam.

## The Market for Gas Securities.

The Lamb attack on the management of the Consolidated Gas Company was a very mild affair in effect, although the demonstration made at the annual meeting was noisy enough to suit either bear or bull. The result of the voting for Directors is told elsewhere. To-day (Friday) the former officers of the Company were re-elected. Yesterday the amateurs who control the affairs of the New Amsterdam Company put their selling rate at 65 cents per 1,000. They are evidently at sea again. It is understood that Mr. Sage intends "to resign" the office of President of the Standard Company. The feature of the city share market for the week was a brisk advance in Standards, and Brooklyn Union moved up sharply. That stock is bound to go very much higher.

The outside market indicates good buying for investment account, with considerable doing in Baltimore Consolidated at advancing prices. Chicago gas should be selling at higher figures than those quoted. Bay State seems to be quickening.

## Gas Stocks.

**Quotations by George W. Close, Broker and Dealer in Gas Stocks.**

16 WALL STREET, NEW YORK CITY.

JAN. 29.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

| *N. Y. City Companies.* | *Capital.* | *Par.* | *Bid.* | *Asked.* |
|---|---|---|---|---|
| Consolidated | $39,078,000 | 100 | 190½ | 194 |
| Central Union, Bonds, 5's. | 3,000,000 | 1,000 | 107½ | 108½ |
| Equitable Bonds, 6's | 1,000,000 | 1,000 | 105 | . |
| " 1st Con. 5's | 2,300,000 | 1,000 | 115 | 18 |
| Metropolitan Bonds | 658,000 | . | 108 | 112 |
| Mutual | 3,500,000 | 100 | 300 | 305 |
| " Bonds | 1,500,000 | 1,000 | 100 | 102 |
| Municipal Bonds | 750,000 | . | . | |
| New Amsterdam Gas Co. | 13,000,000 | 100 | 22 | 25 |
| Preferred | 10,000,000 | 100 | 43½ | 45 |
| Bonds, 5's | 11,000,000 | 1,000 | 92¾ | 93¼ |
| Northern Union, Bonds, 5's. | 1,250,000 | 1,000 | 95 | 97 |
| New York and East River.. | | | | |
| Bonds 1st 5's | 3,500,000 | 1,000 | 109 | 111 |
| " 1st Con. 5's | 1,500,000 | | 112 | 114 |
| Richmond Co., S. I. | 348,530 | 50 | 70 | .. |
| " Bonds | 100,000 | 1,000 | .. | .. |
| Standard | 5,000,000 | 100 | 112 | .. |
| Preferred | 5,000,000 | 100 | 135 | .. |
| Bonds, 1st Mortgage, 5's | 1,500,000 | 1,000 | 110 | 114 |
| Yonkers | 299,65 | 500 | 130 | |
| *Out-of-Town Companies.* | | | | |
| Brooklyn Union | 15,000,000 | 100 | 149 | 149¼ |
| " " Bonds (5's) | 15 000,000 | 1,000 | 118 | 119 |
| Bay State | 50,000,000 | 50 | 1¾ | 1⅞ |
| " Income Bonds | 2,000.000 | 1,000 | .. | 75 |
| Binghamton Gas Works.. | 450,000 | 100 | 40 | .. |
| " 1st Mtg. 5's | 475,000 | 1,000 | 96¼ | 99½ |
| Boston United Gas Co,— | | | | |
| 1s Series S. F. Trust | 7,000,000 | 1,000 | 92 | .. |
| 2d " " " | 3,000,000 | 1,000 | 68 | 71 |
| Buffalo City Gas Co. | 5,500,000 | 100 | 4 | 7 |
| " " Bonds, 5's | 5,250,000 | 1,000 | 72 | 75 |
| Central, San Francisco | 2,000,000 | .. | 106 | 108 |
| Chicago Gas Co. Guaranteed Gold Bonds | 7,650,000 | 1,000 | 104 | 104¼ |
| Columbus (O.) Gas Co., 1st Mortgage Bonds | 1,207,000 | 1,000 | 106 | 108 |
| Columbus (O.) Gas Lt. & Heating Co | 1,682,780 | 100 | 60 | 65 |
| Preferred | 3,626,500 | 100 | 84 | 86 |
| Consumers. Jersey City Bonds | 600,000 | 1,000 | 102 | 105 |
| Cincinnati G. & C. Co. | 8,500,000 | 100 | 193½ | 194½ |
| Consumers, Toronto | 1,700,000 | 50 | 230 | 235 |
| Capital, Sacramento | 500,000 | 50 | .. | 35 |
| Bonds (6's) | 150,000 | 1,000 | .. | .. |
| Consolidated, Baltimore | 11,000,000 | 100 | 55½ | 56 |
| Mortgage, 6's | 3,600,000 | .. | .. | 118 |
| Chesapeake, 1st 6's | 1,000,000 | .. | .. | .. |
| Equitable, 1st 6's | 910,000 | .. | .. | .. |
| Consolidated, 1st 5's | 1,490 000 | .. | .. | 112 |
| Consolidated Gas Co. of N.J. | 1,000,000 | 100 | 21 | 23 |
| " Con. Mtg. 5's | 880,000 | 1,000 | 87 | 90 |
| Consolidated G. & E. Co.'s., Little Falls, N.Y. | 90,000 | 100 | .. | 100 |
| Bonds | 75,000 | .. | .. | 100 |
| Detroit City Gas Co. | 4,560,000 | 50 | 95¾ | 96 |
| " Prior Lien 5's | 4,598,000 | 1,000 | 99½ | 100 |
| Detroit Gas Co., 5's | 386,000 | 1,000 | 100 | 101 |
| " Inc. 5's | 16,000 | 100 | 100¼ | 101 |

| | | | | |
|---|---|---|---|---|
| Equitable Gas & Fuel Co., Chicago, Bonds | 2,000,000 | 1,000 | .. | 101 |
| Fort Wayne | 2,000,000 | .. | 38 | 45 |
| " Bonds | 2,000,000 | .. | 60 | 64 |
| Grand Rapids Gas Lt. Co. | 1,000,000 | 50 | .. | .. |
| " 1st Mtg. 5's | 1,125,000 | 1,000 | .. | .. |
| Hartford | 750,000 | 25 | .. | 220 |
| Hudson County Gas Co., of New Jersey | 10,500,000 | .. | 25 | .. |
| " Bonds, 5's | 10,500,000 | .. | 103 | 105 |
| Indianapolis | 2,000,000 | .. | 100 | 105 |
| " Bonds, 6's | 2 650,000 | .. | 101 | 103 |
| Jackson Gas Co. | 250,000 | 50 | 72 | 73 |
| " 1st Mtg. 5's | 250,000 | 1,000 | 101 | 102½ |
| Lafayette Gas Co., Ind. | 1,000,000 | 100 | 40 | 45 |
| Bonds | 1,000,000 | 1,000 | 60 | 65 |
| Louisville | 3,570,000 | 50 | 106 | |
| Laclede, St. Louis | 7,500,000 | 100 | 79 | 80 |
| Preferred | 2,500,000 | 100 | 95 | 100 |
| Bonds | 10,000,000 | 1,000 | 107 | .. |
| Madison Gas & Elec. Co. | 400,000 | 100 | 82 | .. |
| " 1st Mtg. 6's | 350,000 | 1,000 | 102½ | 108 |
| Montreal, Canada | 2,000,000 | 100 | 200 | .. |
| Newark, N. J., Gas Co. | 16,000,000 | .. | 50 | 60 |
| Bonds, 6's | 4,600,000 | .. | 107 | 108 |
| New Haven | 1,000,000 | 25 | 280 | 300 |
| Nashville Gas Lt. Co. | 1,000,000 | 50 | 110 | .. |
| Oakland, Cal. | 2,000,000 | .. | 43 | 45 |
| " Bonds | 750,000 | .. | .. | .. |
| Peoples G. L. & Coke Co., of Chicago | 25,000,000 | 100 | 103⅝ | 103¾ |
| Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage | 20,100,000 | 1,000 | 111⅜ | 111½x |
| 2d " | 2,500,000 | 1,000 | 104 | 105 |
| Rochester Gas & Elec. Co. | 2,150,000 | 50 | 88 | .. |
| Preferred | 2,150,000 | 50 | 118 | .. |
| Consolidated 5's | 2,000,000 | .. | 87½ | 90 |
| San Francisco, Cal. | 10,000,000 | 100 | 49 | 50 |
| St. Paul Gas Light Co. | 1,500,000 | 100 | 57⅛ | 58⅛ |
| 1st Mortgage 6's | 650,000 | 1,000 | 82 | 85 |
| Extension, 6's | 600,000 | 1,000 | .. | .. |
| General Mortgage, 5's | 2,428,000 | 1,000 | 88 | 90½ |
| St. Joseph Gas Co. | 1,000,000 | 100 | 42 | 44 |
| " 1st Mtg. 5's | 750,000 | 1,000 | 96½ | 98 |
| Syracuse, N. Y. | 1,750,000 | 100 | .. | 15 |
| Bonds | 1,612 000 | 1,000 | 85 | 90 |
| Washington, D. C | 2,000,000 | 20 | 285 | .. |
| First mortgage 6's | 600,000 | .. | .. | .. |
| Western, Milwaukee | 4,000,000 | 100 | 106¾ | 107¾ |
| Bonds, 5's | 3,830,500 | . | 106 | 108 |
| Wilmington, Del. | 600,000 | | 220 | 50 |

# Advertisers' Index.

### GAS ENGINEERS.


Page

Wm. Henry White, New York City ... 195
Fred. Bredel, Milwaukee, Wis. ... 182
Geo. R. Rowland, New York City ... 179
The Western Gas Construction Co., Fort Wayne, Ind. ... 200
Humphreys & Glasgow, New York City ... 180
American Gas Co., Phila., Pa. ... 182
David Leavitt Hough, New York City ... 192
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 179
Baxter & Young, Detroit, Mich. ... 192
United Gas Improvement Co., Phila., Pa ... 187
James T. Lynn, Detroit, Mich. ... 192
A. E. Boardman, Brevard, N. C. ... 192


### GAS WORKS APPARATUS AND CONSTRUCTION.


James R. Floyd's Sons, New York City ... 196
Continental Iron Works, Brooklyn, N. Y. ... 194
Deily & Fowler, Phila., Pa. ... 196
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 192
Stacey Mfg. Co., Cincinnati, Ohio ... 195
Bartlett, Hayward & Co., Baltimore, Md. ... 193
Davis and Farnum Mfg. Co., Waltham, Mass. ... 192
R. D. Wood & Co., Phila., Pa. ... 194
Isbell-Porter Company, New York City ... 194
Fred. Bredel, Milwaukee, Wis. ... 192
United Gas Improvement Co., Phila., Pa. ... 187
National Gas and Water Co., Chicago, Ills. ... 189
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 179
The Western Gas Construction Co., Fort Wayne, Ind. ... 200
Humphreys & Glasgow, New York City ... 180
American Gas Co., Phila., Pa. ... 182
Logan Iron Works, Brooklyn, N. Y. ... 196
Riter-Conley Mfg. Co., Pittsburgh, Pa. ... 195
Baxter & Young, Detroit, Mich. ... 192
Berlin Iron Bridge Co., East Berlin, Conn. ... 181
W. Shepard Page's Sons, New York City. ... 192
James T. Lynn, Detroit, Mich. ... 192
A. E. Boardman, Brevard, N. C. ... 192
Sutherland Construction & Improvement Co., N.Y. City 178
Chris. Cunningham & Son, Brooklyn, N.Y. ... 177


### PROCESSES.


Bartlett, Hayward & Co., Baltimore, Md. ... 193
United Gas Improvement Co., Phila., Pa. ... 187
Burdett Loomis, Hartford, Conn. ... 194
National Gas and Water Co., Chicago, Ills. ... 189
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 179
The Western Gas Construction Co., Fort Wayne, Ind. ... 200
Humphreys & Glasgow, New York City ... 180
Sutherland Construction & Improvement Co., N.Y. City 178
B. E. Chollar, St. Louis, Mo. ... 178


### SCRUBBERS AND CONDENSERS.


R. D. Wood & Co., Phila., Pa. ... 194
James R. Floyd's Sons, New York City ... 196
Continental Iron Works, Brooklyn, N. Y. ... 194
Logan Iron Works, Brooklyn, N. Y. ... 196
Riter-Conley Mfg. Co., Pittsburgh, Pa. ... 195


### TAR AND CARBONIC ACID EXTRACTOR.


R. D. Wood & Co., Phila., Pa. ... 194


### AMMONIA CONCENTRATORS.


Michigan Ammonia Works, Detroit, Mich. ... 176
American Gas Company, Phila., Pa. ... 182


### GAS METERS.


John J. Griffin & Co., Phila., Pa. ... 160
American Meter Co., New York and Philadelphia ... 199
Helme & McIlhenny, Phila., Pa. ... 199
D. McDonald & Co., Albany, N.Y. ... 197
Nathaniel Tufts Meter Co., Boston, Mass. ... 198
Maryland Meter and Mfg. Co., Baltimore, Md. ... 198
Metric Metal Co., Erie, Pa ... 199
Keystone Meter Co., Royersford, Pa. ... 198
Detroit Meter Company, Detroit, Mich. ... 199


### PREPAYMENT METERS.


American Meter Co., New York and Philadelphia ... 199
John J. Griffin & Co., Phila., Pa. ... 160
D. McDonald & Co., Albany, N. Y. ... 197
Helme & McIlhenny, Phila., Pa. ... 199
Nathaniel Tufts Meter Co., Boston, Mass. ... 198


### GAS AND WATER PIPES.


M. J. Drummond & Co., New York City ... 197
R. D. Wood & Co., Phila., Pa. ... 194
Warren Foundry and Machine Co., New York City ... 197
Donaldson Iron Co., Emaus, Pa. ... 197
Chris. Cunningham & Son, Brooklyn, N.Y. ... 177


### PIPE CUTTERS.


The Anderson Pipe Cutter Co., East Boston, Mass. ... 179


### GAS MAIN STOPPERS.


Safety Gas Main Stopper Co., N. Y. City ... 176


### FLEXIBLE JOINTS.


Campbell Mfg. Co., Stamford, Conn ... 136


### STEAM BLOWER FOR BURNING BREEZE.


H. E. Parson, Brooklyn, N. Y. ... 189


### GAS COALS.


Penn Gas Coal Co., Phila., Pa. ... 191
Perkins & Co., New York City ... 190
Despard Gas Coal Co., Baltimore, Md. ... 191
Westmoreland Coal Co., Phila., Pa. ... 191
Berwind-White Coal Mining Co., New York and Phila. ... 190


### CANNEL COALS.


Perkins & Co., New York City ... 190


### CONVEYORS.


The Link-Belt Machinery Co., Chicago, Ills ... 176


### GAS ENRICHERS.


Standard Oil Co., New York City ... 191
The Sun Oil Co., Pittsburgh, Pa. ... 191


### COKE CRUSHER.


C. M. Keller, Columbus, Ind. ... 191


### GAS GAUGES.


The Bristol Co., Waterbury, Conn. ... 180


### GAS GOVERNORS.


Connelly Iron Sponge and Governor Co., New York City 189
Isbell-Porter Co., New York City ... 194
R. D. Wood & Co., Phila., Pa. ... 194
Wm M. Crane Co., New York City ... 197


### CEMENTS.


C. L. Gerould, Galesburg, Ills ... 188


### RETORTS AND FIREBRICKS.


J. H. Gautier & Co., Jersey City, N. J. ... 188
Adam Weber, New York City ... 188
Laclede Firebrick Mfg. Co., St. Louis, Mo. ... 188
Cyrus Borgner, Phila., Pa. ... 18
James Gardner, Jr., Pittsburgh, Pa. ... 188
Henry Maurer & Son, New York City ... 188
Baltimore Retort and Firebrick Co., Baltimore, Md. ... 188
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. ... 188
Brooklyn Firebrick Works, Brooklyn, N. Y. ... 188


### REGENERATIVE FURNACES.


Bartlett, Hayward & Co., Baltimore, Md. ... 193
Fred. Bredel, Milwaukee, Wis. ... 182
J. H. Gautier & Co., Jersey City, N. J. ... 188
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. ... 188
Adam Weber, New York City ... 188


### SELF-SEALING MOUTHPIECE DOORS.


Isbell-Porter Co., New York City ... 194
Continental Iron Works, Brooklyn, N.Y. ... 194
Logan Iron Works, Brooklyn, N. Y. ... 196
R. D. Wood & Co., Phila., Pa. ... 194


### INCANDESCENT GAS LAMPS.


Welsbach Commercial Co., Phila., Pa. ... 186


### BURNERS.


C. A. Gefrorer, Phila., Pa. ... 194
Wm. M. Crane Co., New York City ... 179
D. M. Steward Mfg. Co., Chattanooga, Tenn. ... 179


### LAVA GAS TIPS.


D. M. Steward Mfg. Co., Chattanooga, Tenn. ... 179


### STREET LAMPS.


Welsbach Street Lighting Co., New York and Phila. ... 184
Thos. T. W. Miner, New York City ... 176


### PURIFIERS.


Stacey Mfg. Co., Cincinnati, O. ... 178


### PURIFYING MATERIALS.


Connelly Iron Sponge and Governor Co., New York City 189
van Baarda & Co., Dusseldorf-on-the-Rhine ... 189


### VALVES.


Ludlow Valve Manufacturing Co., Troy, N. Y. ... 180
Chapman Valve Manufacturing Co., Boston, Mass. ... 180
R. D. Wood & Co., Phila., Pa. ... 194
Continental Iron Works, Brooklyn, N. Y. ... 194
The P. H. & F. M. Roots Co., Connersville, Ind. ... 188
Isbell-Porter Co., New York City ... 194
The Western Gas Construction Co., Fort Wayne Ind. ... 200


### EXHAUSTERS.


The P. H. & F. M. Roots Co., Connersville, Ind. ... 188
Isbell-Porter Company, New York City ... 194
Connelly Iron Sponge and Governor Co., New York City 189


### ELECTRICAL APPARATUS.


Wm Henry White, New York City ... 195


### ENGINES AND BOILERS.


The Hazelton Boiler Company, New York City ... 176


### PURIFIER SCREENS.


John Cabot, New York City ... 180


### GAS STOVES.


American Meter Co., New York and Philadelphia ... 185
Maryland Meter and Manufacturing Co., Baltimore, Md. 198
Keystone Meter Co., Royersford, Pa. ... 198
Wm. M. Crane Co., New York City ... 177
Nathaniel Tufts Meter Co., Boston Mass. ... 198


### HOT WATER HEATERS.


Wm. M. Crane Co., New York City ... 177


### GASHOLDER TANKS.


J. P. Whittier, Brooklyn, N. Y. ... 180


### GASHOLDERS.


Bartlett, Hayward & Co., Baltimore, Md. ... 193
Continental Iron Works, Brooklyn, N. Y. ... 194
Deily & Fowler, Philadelphia, Pa. ... 196
Davis & Farnum Mfg. Co., Waltham, Mass. ... 192
Kerr Murray Mfg. Co., Fort Wayne, Ind. ... 192
Stacey Mfg. Co., Cincinnati, Ohio ... 195
R. D. Wood & Co., Philadelphia, Pa. ... 194
Logan Iron Works, Brooklyn, N. Y. ... 196
Riter-Conley Mfg. Co., Pittsburgh, Pa. ... 195
Chris. Cunningham & Son, Brooklyn, N.Y. ... 177


### GAS SECURITIES.


Henry Marquand & Co., New York City ... 176

**ADVERTISING.**

J. Howland Harding, New York City..... 176

**BOOKS, ETC.**

Newbigging's Handbook..... 184
Field's Analysis, 1898..... 181
Scientific Books..... 190
Digest of Gas Cases..... 191
Practical Photometry..... 188
Gas Flow Computers..... 191
Hughes' "Gas Works"..... 189
Gas Engineer's Pocket-Book..... 180
Excerpts from Reports of Gas Commissioners..... 193
Poole on Fuels..... 159
Binders..... 197
Directory of Gas Companies..... 195
Practical Handbook on Gas Engines..... 184
Coal Tar Tree..... 180



## Position Wanted

**In a Coal or Water Gas Works.**

A good business man, with 15 years' experience in both water and coal gas plants, wants to get position where a hustler will be appreciated. Is particularly well fitted to increase the business and build up old plants. Have the best of references, including present employer.

1286-5 Address "W. L.," care this Journal.

## Position Wanted

**As Manager or Engineer of a Gas Company.**

A Thoroughly Competent Gas Manager of many years' experience in the manufacturing and the executive ends of a Gas Company desires a position as Manager or Engineer of a Gas Company selling not less than 50,000,000 cubic feet per annum. Highest references given. Address "T."

1267-tf Care this Journal.

## SUPERINTENDENT WANTED,

**To Take Full Charge of a Gas Plant,**

In a town of about 12,000 inhabitants. Must understand the manufacture of coal and water gas.

Address "SUPERINTENDENT,"
Care this Journal.

## WANTED,

**A Sober, Reliable Gas Engineer,**

Acquainted with coal gas construction. Young man preferred.

Address E. FLORENCE,
1286-1 356 Dearborn St., Room 607, Chicago, Ills.

## King's Treatise

A second hand set of King's Treatise, in good order, wanted by

"ENGINEER," care this Journal.

## For Sale.

**A Small Gas and Electric Light Plant,**

in a Southern city of 3,600 inhabitants.

Address FORT WAYNE ELECTRIC CORPORATION,
1097-tf Fort Wayne, Ind.

## FOR SALE

**And Immediate Delivery at Harlem Station Gas Works, 111th Street and 1st Avenue, New York City:**

**Two Gas Exhausters,** Isbell & Porter, manufacturers. Each 150,000 cubic feet capacity per hour, with four gate valves and connections, bye pass and compensator.

**Two Continental Iron Works Beam Engine Eyes,** 12-inch by 18-inch stroke, with gas governors. One Fresby clutch shaft with pulleys and belts. Room 32 by 86 feet.

**One Vertical Scrubber,** Continental Iron Works, manufacturers, 14 feet diameter, 32 feet high, with 12 stationary and 12 revolving trays operated from underneath; also overhead truck connection, 20-inch, capacity 1,000,000 feet.

**One Horizontal Eclipse Scrubber,** English manufacture, capacity 2,000,000 feet. Length 17 feet 2 inches, width 7 feet 6 inches, height 7 feet 6 inches. Connection and valves 20-inch; also wall countershaft and gearing.

**Two Horizontal Boilers,** 48 feet by 12 feet, with 43 tubes 3½ inch. Complete with ornamental fronts, stays and ties, and all fittings; also iron roof frame, 30 feet by 24 feet.

**One Iron Water Tank,** 20 feet diameter, 20 feet high, resting on six 15-inch T-beams.

**A Worthington Compound Duplex Steam Pump,** with all fittings, and an iron ladder 65 feet high.

**A Composite Roof Frame** composed of nine trusses with yellow pine rafters and iron twist members. All for a room 57½ feet by 121 feet inside.

**A Quantity of Cast Iron Wall-Light Boxes.**

☞All above materials are in excellent condition, having been used less than two years. For terms, etc., apply to

**J. REEBER'S SONS,**

1285-1 107th St. & East River, New York City.

## MRS. HELEN ARMSTRONG,

Teacher of Cookery.

**Demonstration Lectures for Gas Companies a Specialty.**

Address

159 W. 66th St., Chicago, Ills.

**Utilize Your Gas Liquor.**

NO EXTRA LABOR OR OPERATING EXPENSES.

**Ammonia Concentrator,**

Not Expensive. Write to STROH & OSIUS, Pat'ees, or Mich. Ammonia Works, Detroit, Mich.

## HENRY MARQUAND & CO.,

**BANKERS**

AND

**BROKERS.**

**160 Broadway, New York City.**

## "THE MINER"

**Globe**

Street and Boulevard

**Lamps.**

**Cheapest and Best.**

THOUSANDS IN USE WITH INCANDESCENT BURNERS.

*Send for Catalogues.*

**THOMAS T. W. MINER,**

821-823 Eagle Av., N.Y.

## REMOVAL NOTICE.

# The Hazelton Boiler Company

have removed to their NEW WORKS at Rutherford, New Jersey.

Please address all communications to the Company at their New Office, **120 Liberty Street, N. Y. City.**

## SAFETY GAS MAIN STOPPER Co.

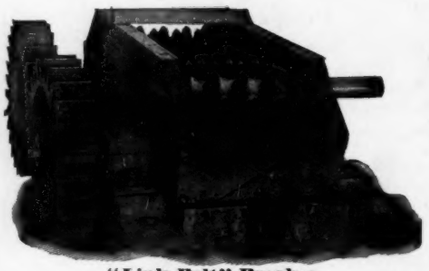
211-E. 116 TH ST. N.Y.

**FOR SHUTTING OFF GAS IN MAINS TEMPORARILY DURING ALTERATIONS AND REPAIRS**

## THE LINK-BELT MACHINERY CO.,

**ENGINEERS, FOUNDERS, MACHINISTS,**

**Chicago, U. S. A.**



"Link-Belt" Breaker.

**LINK-BELT** ELEVATING & CONVEYING MACHINERY for HANDLING COAL, COKE, OXIDE, ETC

**Tilting Coal and Coke Cars, Breaker Rolls, Shaking Screens, Power Transmitting Machinery**

Machinery designed and erected to suit existing conditions and available space.

CATALOGUE UPON APPLICATION

# OUR NEW CATALOGUE,

Illustrating Cooking Appliances, will be mailed the latter part of January. Write for prices on **Ranges, Water Heaters, Etc.,** before placing your orders.

*****

SOLE AGENTS FOR BRAY BURNERS,

## WILLIAM M. CRANE COMPANY,

**1131 & 1133 Broadway, New York.**

*****

**Foundry at Peekskill, N. Y.**

---

## CHRIS. CUNNINGHAM & SON,

PROPRIETORS,

# THE NOVELTY STEAM BOILER WORKS,

**BROOKLYN, N. Y.**

---

## STORAGE TANKS FOR GAS WORKS,

To Retain Fluid Material of Any Sort.

---

## PIPING IN AND AROUND GAS WORKS.

---

Work Done for Several of the Largest Gas Companies in America Stands as Reference.

# Sutherland Construction & Improvement Co.

**Offices: 15 WALL ST., NEW YORK, and OSHKOSH, WISCONSIN.**

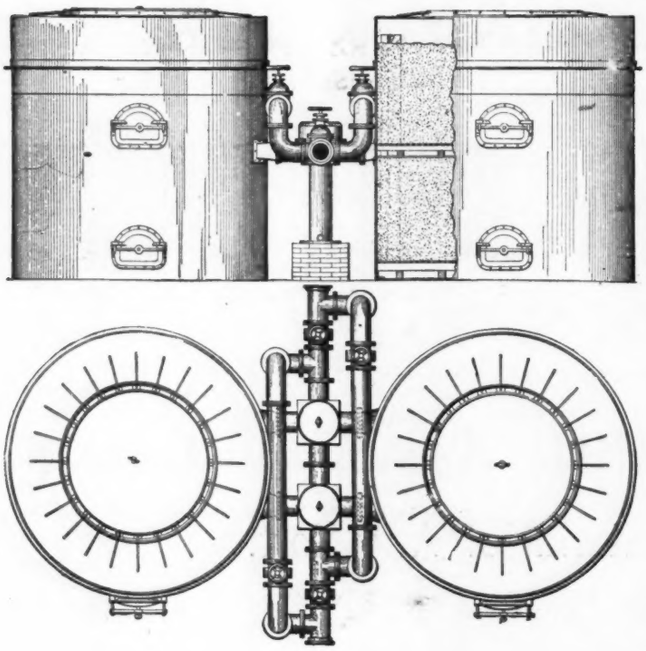
Owners of the "SUTHERLAND" Patents for Water Gas Apparatus.

## Gas, Electric Light, Water Works, and Electric Street Railways Built, Remodeled, Operated, Bought and Sold.

**A few of the places where the SUTHERLAND Apparatus is in successful operation:**

Ilion, N. Y.
Herkimer, N. Y., 2 orders.
Little Falls, N. Y.
Fishkill-on-Hudson, 2 orders.
Clifton Springs, N.Y., 2 orders.
Green Bay, Wis.
Stevens Point, Wis.
Tarrytown, N.Y., 3 orders.
Ft. Henry, N. Y.
Gainsville, Fla.
Hollidaysburg, Pa.
Waterville, N. Y.
Huntington, L. I.
Lexington, Mo.
Mendota, Ill.
Circleville, O.
Joplin, Mo.
Ashville, N. C.
Youngstown, O.
Kingston & Rondout, N. Y.

CORRESPONDENCE SOLICITED.



## CHOLLAR'S SYSTEM OF GAS PURIFICATION.

Covered by Five U.S. Patents.

In operation, revivification of the oxide is effected by repeated reversals of the direction of the flow of the gas through the beds (in the two boxes used under this system there are eight different routes for the gas to take) whereby the purified gas is made to revive the oxide in parts of the apparatus while the foul gas is fouling it in others.

The boxes are charged or discharged from the sides as well as the top.

There are no Hydraulic Cups or heavy covers.

Either end of the apparatus is inlet or outlet at pleasure.

The capacity is increased five-fold or more over ordinary methods without addition to building.

The apparatus costs less than for any other system.

For Estimates Write **The Stacey Mfg. Co.,**
SOLE MANUFACTURERS,
CINCINNATI, OHIO.

FOR FURTHER INFORMATION WRITE
B. E. CHOLLAR, 411 N. 11th St., St. Louis, Mo.

## Coal Tar Genealogical Tree.

Mr. T. Viner Clarke, of London, Eng., having compiled a novel Chart or Map illustrating the various CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR, in the form of a Genealogical Tree, including all the products discovered (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

**A. M. CALLENDER & CO., No. 32 Pine Street, New York**

W. H. PEARSON, Prest. W. H. PEARSON, Jr., Vice-President. J. T. WESTCOTT, M.E., Manager. L. L. MERRIFIELD, M.Inst.M.E., Chief Engineer.

# THE ECONOMICAL GAS APPARATUS CONSTRUCTION CO., LD.

American Offices: 269 FRONT STREET, EAST, TORONTO, ONT.
London Offices: 19 ABINGDON STREET, WESTMINSTER, S.W.

Telegraphic Address: "CARBURETED LONDON AND TORONTO."

**The above Company have erected since 1893, or are now erecting, their universal type of Carbureted Water Gas Plants at the following Gas Works:**

| | Cubic Feet Daily. |
|---|---|
| Blackburn, Eng. | 1,250,000 |
| Windsor Street Works, Birmingham, Eng. | 2,000,000 |
| Saltley Works, Birmingham, Eng. | 2,000,000 |
| Colchester, Eng. | 300,000 |
| Birkenhead, Eng. | 2,250,000 |
| Swindon (New Swindon Gas Co.), Eng. | 120,000 |
| Saltley Works, Birmingham, Eng. (2d Contract) | 2,000,000 |
| Windsor St. W'ks, Birming'm, Eng. (2d Contract) | 2,000,000 |
| Halifax, Eng. | 1,000,000 |
| Toronto, | 250,000 |
| Ottawa, | 250,000 |
| Toronto (Second Contract, Remodeled), | 2,000,000 |
| Lindsay (Remodeled), | 125,000 |
| Belleville, | 250,000 |
| Ottawa (Second Contract), | 250,000 |
| Brantford (Remodeled) | 200,000 |
| St. Catherine's (Remodeled), | 250,000 |
| Kingston, Pa. | 125,000 |
| Montreal, | 500,000 |
| Peterborough, Ont. | 250,000 |
| Wilkesbarre, Pa. | 750,000 |
| St. Catherine's (Second Contract), | 250,000 |
| Buffalo, N. Y. | 2,000,000 |
| Winnipeg, Man. | 500,000 |
| Colchester, Eng. (Second Contract), | 300,000 |
| York, Eng. | 750,000 |
| Rochester, Eng. | 500,000 |
| Kingston, Ont. | 300,000 |
| Crystal Palace District, Eng. | 2,000,000 |
| Duluth, Minn. | 300,000 |
| Caterham, Eng. | 150,000 |
| Enschede, Holland, | 150,000 |
| Leicester, Eng. | 2,000,000 |
| Buenos Ayres (River Platte Co.), | 700,000 |
| Burnley, Eng. | 1 500,000 |

# PHOTOMETRIC

Tests made by the EXPERTS of

## New York, Chicago

and other large cities, give

## Steward's Burners

HIGHER CANDLE POWER THAN ANY OTHER UNION JET BURNER.

## The D. M. Steward Mfg. Co.,

New York Office, 107 CHAMBERS ST.

CHATTANOOGA, Tenn.

SEND FOR OUR BLUE BOOK ON GAS LIGHTING.

## IF BRAY'S SPECIAL BURNERS ARE THE BEST,

YOU CANNOT AFFORD TO USE ANY OTHER.

Gem Self-Lighting Burner, with Bray Regulator (or Tip).

Surpass the ordinary, so-called "lava" tip by as much as the ordinary gas burner surpasses the candle of our forefathers. Used throughout the world by the leading Gas Companies. Used for Standard Test by New York, Chicago and the leading cities of the United States.

Union Jet Special.

Sole Agents for the United States,

## W. M. CRANE COMPANY,

1131 AND 1133 BROADWAY, NEW YORK.

## GEORGE R. ROWLAND.

Formerly with the Continental Iron Works.

**Draughtsman and Constructing Engineer.**

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

Office, No. 245 Broadway, N. Y. City.

## THE ANDERSON Patent Cutter Carrying Link

Made in all sizes.

Will cut from 2 in. to 24 in.

## Pipe Cutting Tool

For Cutting Cast, Wrought Iron, Gas & Water Pipes.

THE ANDERSON PIPE CUTTER COMPANY, Manufacturers, 163 Liverpool st., E. Boston, Mass
N. Y. Office, 135 Greenwich St. C. H. TUCKER, Jr., Manager.
WALDO BROS., 103 Milk Street, Boston, Mass.

## Practical Photometry.

By William Joseph Dibdin.

Price, $3.00.

A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY

## Practical Hints on the Construction and Working of Regenerator Furnaces,

By MAURICE GRAHAM, Assoc. M. Inst. C.E.

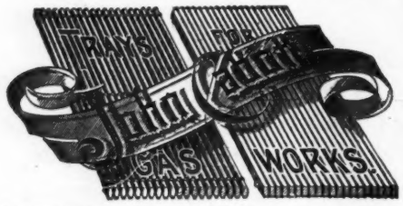
**Price, $1.25.** For Sale by

A. M. CALLENDER & CO., No. 32 Pine Street, New York City.

Special Trays for Iron Sponge or Oxide of Iron,

**CHURCH'S TRAYS a Specialty.**

Reversible, Strongest, Most Durable, Most Easily Repaired.




**553-557 West Thirty-third Street, New York.**

We also make the Cheapest and Strongest
REVERSIBLE BOLTED TRAYS IN THE MARKET.
*Send for Circulars.*

ALEX. C. HUMPHREYS, M.E., M. nst. C.E. ARTHUR G. GLASGOW, M.E., M. Inst. C.E.

# HUMPHREYS & GLASGOW,

**BANK OF COMMERCE BLDG.,**
**31 Nassau Street,**
**New York.**

**9 VICTORIA STREET**
**London, S.W.,**
**England.**

**CONSULTING GAS ENGINEERS**
**AND MANAGERS.**
**GAS PROPERTIES PURCHASED.**

Bristol's Recording
**PRESSURE GAUGE.**
For continuous records of
**Street Gas Pressure.**
Simple in construction, accurate in operation, and low in price.
Fully Guaranteed. Send for Circulars.

**THE BRISTOL CO.,**
Waterbury, Conn.

## CHAPMAN VALVE MANUFACTURING CO.

MANUFACTURERS OF

**Valves and Gates for Gas, Ammonia, Water, Etc.**

**Also, Gate Fire Hydrants with and without Independent Nozzle Valve. All Work Guaranteed.**

Works & Gen'l Office, Indian Orchard, Mass. Treasurer's Office, 72 Kilby & 112 Milk Sts., Boston, Mass.
Chicago Office, 24 West Lake St. New York Office, 28 Platt St.
St. Louis Office, L. M. Rumsey Mfg. Co., 810 North Second St.

**GASHOLDER TANKS AND**
**GAS WORKS MASONRY COMPLETE**

Plans prepared and Estimates furnished at short notice.

**J. P. WHITTIER,**

**70 Rush St.,** Near Division Ave., **Brooklyn, N. Y.**

THE
**Ludlow Valve Mfg. Co.,**
**TROY, N. Y., U. S. A.**

Double and Single Gate Valves, ¼" to 72",
—FOR—
**Gas, Water, Steam, Oil, Ammonia, Etc.**

**HOT GAS VALVES A SPECIALTY.**

**Send for Catalogue.**

# THE GAS ENGINEER'S POCKET-BOOK.

**By HENRY O'CONNOR.**

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

Price, - - $3.50.

**A. M. CALLENDER & COMPANY, No. 32 Pine Street, N. Y. City.**

# Coal Tar Genealogical Tree

MR. T. VINER CLARKE, of London, Eng.,

Having compiled a novel Chart or Map illustrating the various

**CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR,**

in the form of a Genealogical Tree, including all the products discovered to date (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

**A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.**

# WE HAVE IN STOCK

At East Berlin, Conn., about 10,000 tons of Beams, Channels, Angles, Plates, etc., as follows:

**CHANNELS.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 100 | bars | . | 3-inch | . | 4 | pounds | per | ft. |
| 250 | " | . | 4 " | . | 5¼ | " | " | |
| 130 | " | . | 5 " | . | 6½ | " | " | |
| 250 | " | . | 6 " | . | 8 | " | " | |
| 320 | " | . | 7 " | . | 9¾ | " | " | |
| 430 | " | . | 8 " | . | 11¼ | " | " | |
| 80 | " | . | 9 " | . | 13 | " | " | |
| 100 | " | . | 10 " | . | 15 | " | " | |
| 50 | " | . | 10 " | . | 16 | " | " | |
| 225 | " | . | 12 " | . | 20½ | " | " | |

**I BEAMS.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 110 | bars | . | 3-inch | . | 5½ | pounds | per | ft. |
| 375 | " | . | 4 " | . | 7½ | " | " | |
| 330 | " | . | 5 " | . | 9¾ | " | " | |
| 155 | " | . | 6 " | . | 12¼ | " | " | |
| 200 | " | . | 7 " | . | 15 | " | " | |
| 50 | " | . | 7 " | . | 12¼ | " | " | |
| 250 | " | . | 8 " | . | 17½ | " | " | |
| 95 | " | . | 9 " | . | 21 | " | " | |
| 155 | " | . | 10 " | . | 25 | " | " | |
| 200 | " | . | 12 " | . | 31½ | " | " | |
| 200 | " | . | 12 " | . | 40 | " | " | |
| 265 | " | . | 15 " | . | 42 | " | " | |
| 150 | " | . | 15 " | . | 50 | " | " | |
| 180 | " | . | 15 " | . | 60 | " | " | |
| 25 | " | . | 20 " | . | 65 | " | " | |

In addition we also have all sizes of Angles both with even and uneven legs, from 1 x 1 x ⅛ in. to 6 x 6 x ¾ in., and Plates from 6 in. to 60 in. in width. We also have a fair stock of Zee bars, Tee iron and special shapes. All of this material in lengths from 40 ft. to 50 ft. We can ship promptly, and should be pleased to receive your order. Prices on Application.

THE BERLIN IRON BRIDGE CO.,
EAST BERLIN, CONN.

# FIELD'S ANALYSIS

**For the Year 1898.**

**An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the Thirtieth Year of Publication.**
**Compiled and Arranged by**

## JOHN W. FIELD,

**Secretary and General Manager of The Gas Light and Coke Co., London.**

**Price $5. For Sale by**

**A. M. CALLENDER & CO., - No. 32 Pine Street, N. Y. City.**

# AMERICAN GAS COMPANY

## Constructors of Coal Gas Apparatus.

KLONNE-BREDEL

**Recuperative Furnaces, Washers, Condensers, Purifiers and Purifying Machines, Ammonia Plant, Coke Conveyers, Etc.**

## Complete Works Erected with Guaranteed Results.

EASTERN AGENTS FOR

**FRED. BREDEL'S SYSTEM**
COAL GAS PLANTS AND GAS APPARATUS.

**P. H. & F. M. ROOTS CO.'S**
Exhausters, Blowers, etc.

**222 South Third Street, Philadelphia, Pa.**

**GEORGE G. RAMSDELL, General Manager.** **Correspondence Solicited**

# FRED. BREDEL, C.E.

## Coal and Water Gas Plants.

**OWN SYSTEM.**

RECUPERATIVE FURNACES, WASHERS, CONDENSERS, PURIFIERS, PURIFYING MACHINES, COKE CONVEYERS, ETC

SOLE UNITED STATES AGENT FOR
ARROL-FOULIS MECHANICAL CHARGING AND DRAWING MACHINES.

Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas

**GAS RETORTS AND SPECIAL BLOCKS AND FIREBRICK MANUFACTURED UNDER THE SUPERINTENDENCE OF MY OWN CHEMIST.**

COMPLETE GAS WORKS

**No. 118 Farwell Avenue, · Milwaukee, Wis.**

**Eastern Agents: AMERICAN GAS CO., Construction Department, 222 So. 3d St., Phila., Pa**

# ROOTS'

## LATEST IMPROVED GAS EXHAUSTER

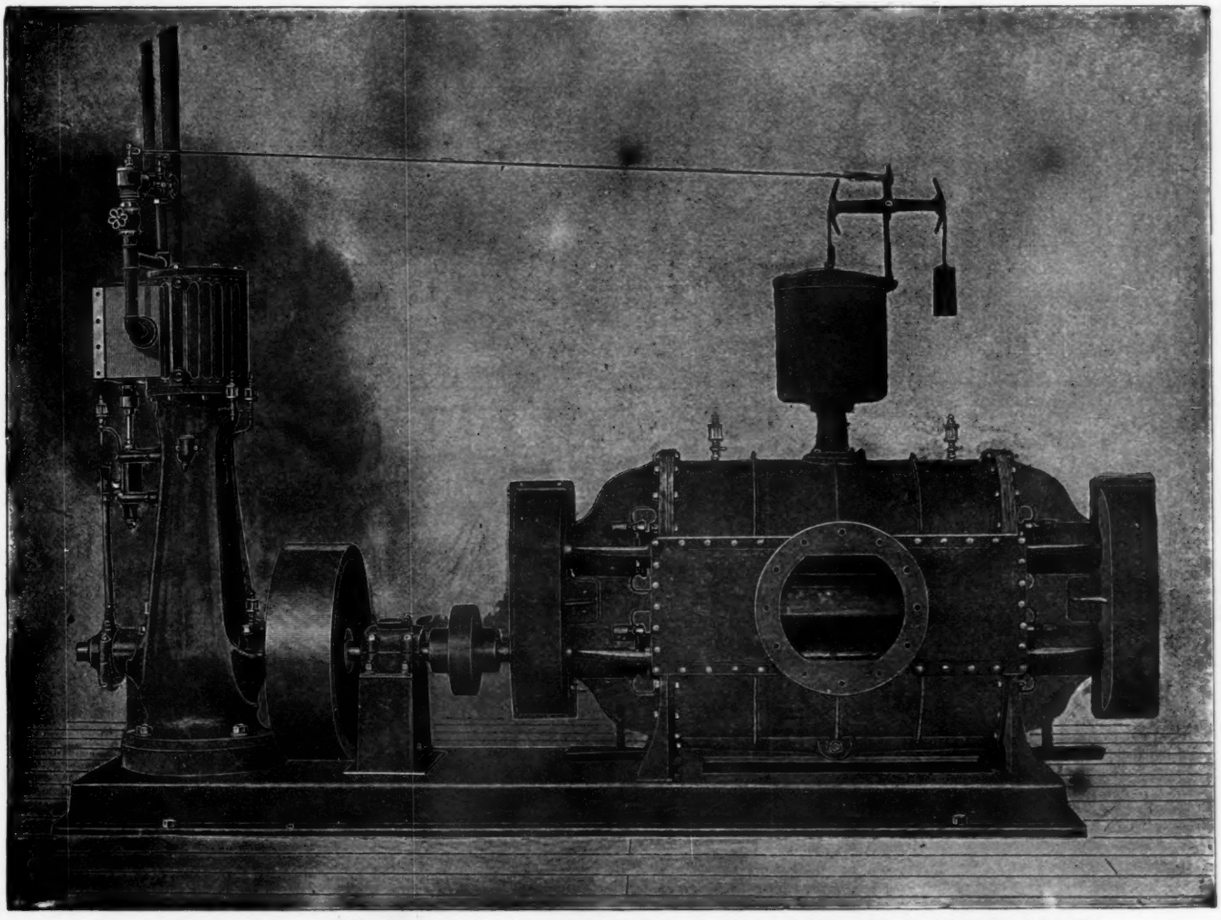
—AND—

## NEW GAS GOVERNOR AND STEAM VALVE.

GUARANTEED TO REGULATE WITHIN ONE-TENTH OF AN INCH, WATER PRESSURE.

## The Most Perfect Gas Governor on the Market.

MORE DIRECT IN ACTION. FEWER PARTS.
EASIER TO ADJUST THAN ANY OTHER GOVERNOR.



INQUIRIES CHEERFULLY ANSWERED. WRITE FOR CATALOGUE.

# P. H. & F. M. ROOTS CO.,

**Connersville, Ind.** **109 Liberty St., New York.**

**Eastern Office:**

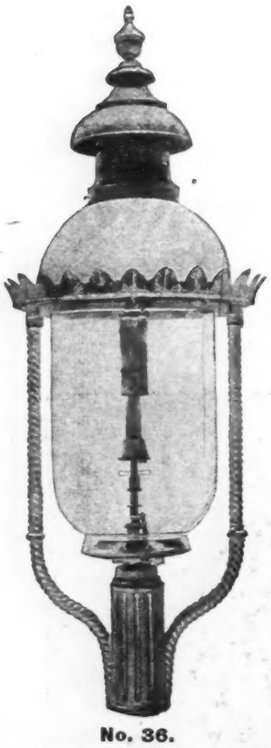
## American Gas Company,

**222 South Third Street, Philadelphia, Pa.**

NEW YORK, 33 Nassau St. PHILADELPHIA, Broad and Arch Sts. CHICAGO, 54 Lake St.

# Welsbach Street Lighting Company

.... OF AMERICA ....



No. 36.

Controls and Operates the

## Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in seventy-five Cities and Towns.

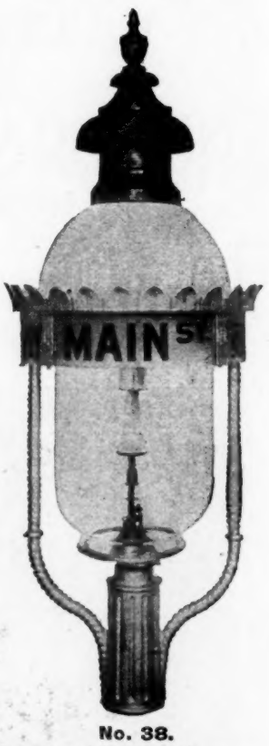
By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.




No. 38.

Correspondence solicited from Gas Companies and others interested in Municipal and outside lighting.

NOW READY.

THE SIXTH (AND CENTENARY) EDITION

— OF THE —

# Handbook for Gas Engineers and Managers.

By THOMAS NEWBIGGING, M. Inst. C.E.

This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry.

**PRICE, - - $6.00.**

A. M. CALLENDER & CO., - - No. 32 Pine Street, N. Y. City.

PRACTICAL HANDBOOK ON

# GAS ENGINES

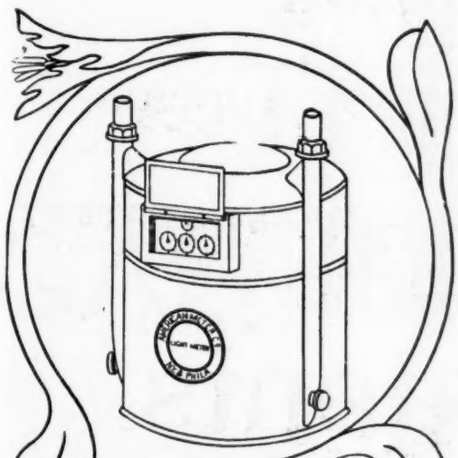
With Instructions for Care and Working of the Same.

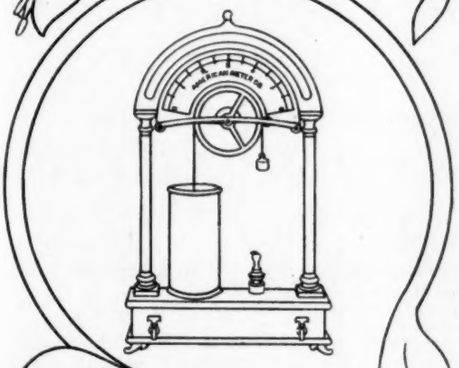
By G. LIECKFELD, C.E.

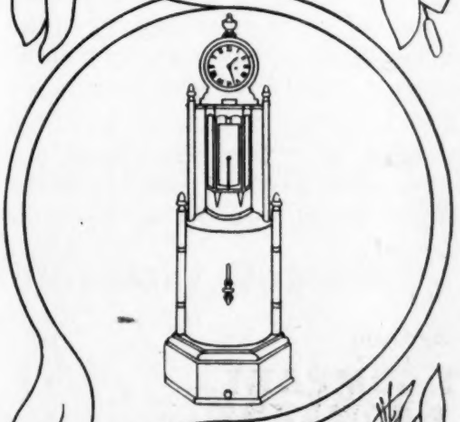
Translated with Permission of the author by GEO. M. RICHMOND, M.E.

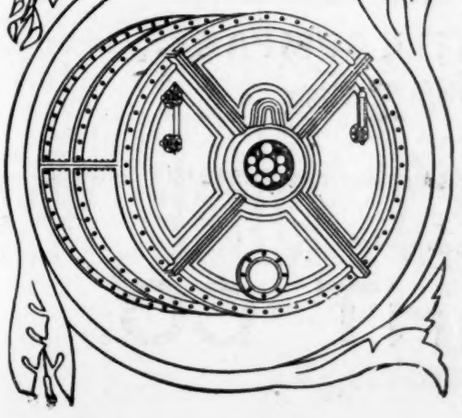
Price, $1.00.

**A. M. CALLENDER & CO., 32 Pine Street, New York.**









(Copyrighted, 1894, by the AMERICAN METER CO.

# AMERICAN METER CO.

ESTABLISHED 1834. INCORPORATED 1868.

**NEW YORK AND PHILADELPHIA,**

**CHICAGO, ST. LOUIS,**

**SAN FRANCISCO.**

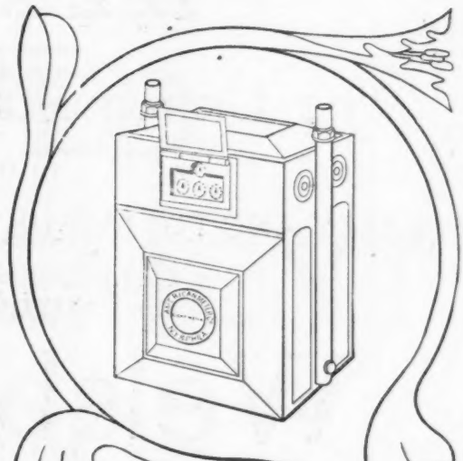
## PUBLIC LIGHTING TABLE.

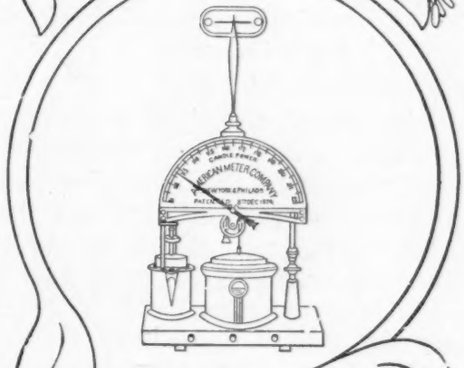
### FEBRUARY, 1900.

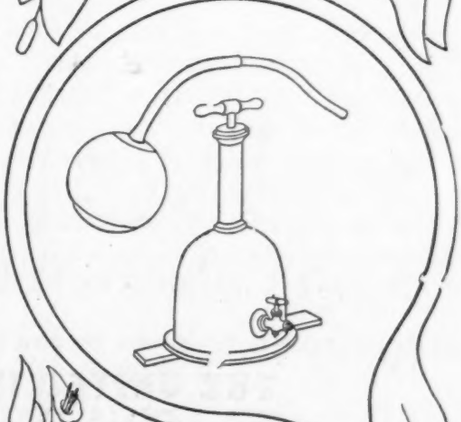
| Day of Week. | Table No. 1. Following the Moon. Date. | Light. | Extinguish. | Table No. 2. New York City. All Night Lighting. Light. | Extinguish. |
|---|---|---|---|---|---|
| | | | | P.M. | A.M. |
| Thu. | 1 | 5.50 PM | 6.10 AM | 5.05 | 6.15 |
| Fri. | 2 | 5.50 | 6.10 | 5.05 | 6.15 |
| Sat. | 3 | 5.50 | 6.10 | 5.05 | 6.15 |
| Sun. | 4 | 10.20 | 6.00 | 5.05 | 6.15 |
| Mon. | 5 | 11 30 | 6.00 | 5.10 | 6.10 |
| Tue. | 6 | 12.40 AM LQ | 6.00 | 5.10 | 6.10 |
| Wed. | 7 | 1.40 | 6.00 | 5.10 | 6.10 |
| Thu. | 8 | 2.30 | 6.00 | 5.10 | 6.10 |
| Fri. | 9 | 3.20 | 6.00 | 5.10 | 6.10 |
| Sat. | 10 | 4.00 | 6.00 | 5.10 | 6.10 |
| Sun. | 11 | 4.40 | 6.00 | 5.10 | 6.10 |
| Mon. | 12 | 5.10 | 6.00 | 5.20 | 5.55 |
| Tue. | 13 | No L. | No L. | 5.20 | 5.55 |
| Wed. | 14 | No L. FM | No L. | 5.20 | 5.55 |
| Thu. | 15 | No L. | No L. | 5.20 | 5.55 |
| Fri. | 16 | 6.10 PM | 9.00 PM | 5.20 | 5.55 |
| Sat. | 17 | 6.10 | 9.50 | 5.20 | 5.55 |
| Sun. | 18 | 6.10 | 10.50 | 5.20 | 5.55 |
| Mon. | 19 | 6.10 | 11.50 | 5 30 | 5.55 |
| Tue. | 20 | 6.10 | 12.50 AM | 5.30 | 5.55 |
| Wed. | 21 | 6.10 | 1.50 | 5.30 | 5.55 |
| Thu. | 22 | 6.10 LQ | 2.50 | 5.30 | 5.55 |
| Fri. | 23 | 6.10 | 3.40 | 5.30 | 5.55 |
| Sat. | 24 | 6.10 | 4.40 | 5.30 | 5.55 |
| Sun. | 25 | 6.20 | 5.30 | 5.30 | 5.55 |
| Mon. | 26 | 6.20 | 5.30 | 5.30 | 5.45 |
| Tue. | 27 | 6.20 | 5.30 | 5.30 | 5.45 |
| Wed. | 28 | 6.20 NM | 5.30 | 5.30 | 5.45 |

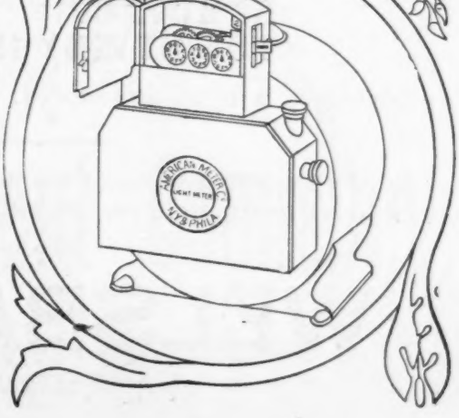
### TOTAL HOURS LIGHTING DURING 1900.

| By Table No. 1. | Hrs.Min. | By Table No. 2. | Hrs.Min. |
|---|---|---|---|
| January | 230.50 | January | 423.20 |
| February | 175.40 | February | 355 25 |
| March | 189.00 | March | 355.35 |
| April | 160.30 | April | 298.50 |
| May | 150.40 | May | 264.50 |
| June | 137.00 | June | 234.25 |
| July | 152 00 | July | 243.45 |
| August | 171.50 | August | 280.25 |
| September | 187.20 | September | 321.15 |
| October | 213.10 | October | 374.30 |
| November | 221.50 | November | 401.40 |
| December | 231.50 | December | 433.45 |
| Total, yr. | 2221.40 | Total, yr. | 3987.45 |









# THE RECENT DECISION.

## The United States Circuit Court of Appeals,

**In Its Opinion of December 7, 1899,**

**FINALLY AND FULLY SUSTAINS THE WELSBACH COMPANY'S PATENT.**

**DEALERS and USERS and MANUFACTURERS are CAUTIONED against INFRINGEMENT of the**

# Welsbach Patents.

Judge LACOMBE, in the United States Circuit Court, handed down the following opinion Saturday, Dec. 9, 1899.

On motion to restrain complainant from sending circulars to the customers of American Incandescent Lamp Company.

LACOMBE, Circuit Judge.

Irrespective entirely of the preliminary objection that affirmative relief of this sort will not be granted to defendant—a question not now passed upon—there seem no good grounds for criticism of complainant's circular. It states that Judge Townsend enjoined the "manufacture and sale" of infringing mantles, and he did grant such an injunction. And this Court has enjoined the sale of mantles which the person enjoined did not himself manufacture, when his past conduct in the matter of infringement created a special equity in favor of the complainant against him. It is true that the circular goes further, and threatens suit against persons who sell mantles, but who never have been at all concerned in manufacturing or causing them to be manufactured.

In other words, it threatens suit upon the patent as if it were a patent for a product. But the complainant insists that the threat is made in good faith; that it intends to bring suits against sellers of the infringing mantles upon the theory that the patent is really one for a product. In view of the peculiar language of the claim, this Court is not now prepared to hold that such contention would be wholly without merit, or that the complainant could not succeed against a mere seller. Moreover, it is contended that the seller of a purchased mantle himself promotes the taking of the final step in the process, and such contention has not yet been passed upon adversely to complainant. These are questions which should be left to be determined in one of such suits, rather than here. If complainant intends to prosecute one or more sellers, and there is nothing before the Court to induce a disbelief in its assertion that it does so intend, it would seem to be its proper course to warn dealers to desist from selling.

December 9, 1899.

**Restraining orders issued in the United States Circuit Courts against—**

**THE UNITED INCANDESCENT LIGHT COMPANY.**
**ST. LOUIS INCANDESCENT MANTLE COMPANY.**
**ECKERLE ELECTRICAL COMPANY.**
**H. KUPFER.**
**THE NEWBY INCANDESCENT MANTLE COMPANY.**

**All infringers will be prosecuted, whether Manufacturers, Dealers or Users.**

**TO THE PUBLIC: Avoid Liability of infringement! Take nothing but the GENUINE always in sealed boxes bearing our registered trademark, "WELSBACH."**

# WELSBACH LIGHT CO.

**Salesrooms in all the leading cities throughout the United States.**

# THE UNITED GAS IMPROVEMENT COMPANY.

THE STANDARD JUNIOR,

THE STANDARD DOUBLE SUPERHEATER,

LOWE WATER GAS APPARATUS.

Total Sets Installed to January 1, 1900, - - - - - - - - 327

Total Daily Capacity - - - - - - - - - 207,425,000 Cu. Ft.

**WATER GAS PLANT AS AUXILIARY TO COAL GAS WORKS.**

## The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY Prest. DAVID R. DALY V. Prest. & Treas.
H. D. ABERNETHY. Sec.

**J. H. Gautier & Co.**

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

E. D. WHITE, President. A. H. GUTKES, Vice-President. H. A. PERKINS, Secretary.

**Brooklyn Fire Brick Works,**

MANUFACTURERS OF

CLAY RETORTS, FIRE BRICK,
Gas House and other Tile.

Office, 88 Van Dyke St. Brooklyn, N. Y.

Established 1854. Incorporated 1869.

**LACLEDE**
**Fire Brick Manufg. Co.,**

Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Exclusive Agents for

The Mitchell Half-Depth Regenerative Furnace.

This is the *original* coal-consuming Furnace for Retort Benches. Burns either Coal or Coke. Full and Half-Depth Regenerative Furnaces for Benches of 6's, 7's, 8's or 9's erected complete.

Proprietors of the Coze System of Inclined Retorts.

Office: 901 Pine St., **St. Louis, Mo.**

**The Construction of Gas Works**

PRACTICALLY DESCRIBED,

By WALTER RALPH HERRING.

Price $2. For Sale by

A. M. CALLENDER & CO.,

32 Pine Street, N. Y. City.

**Adam Weber,**

Proprietor,

Manhattan Fire Brick and Enameled Clay Retort Works.

**Works, Weber, N. J.**

Office, 633 East 15th St., New York.

Modern Recuperative Furnaces

And Standard Fire Brick and Gas Retorts

Works, LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

**JAMES GARDNER, JR.,**

Hamilton Building, Fifth Avenue PITTSBURGH, PA. P. O. Box 372.

Successor to WILLIAM GARDNER & SON

**Fire Clay Goods for Gas Works.**

SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

**HENRY MAURER & SON,**

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

**RETORT WORKS**

WORKS, Perth Amboy, N. J.

OFFICE, 418 to 422 East 23d St., N. Y.

**Clay Gas Retorts,**

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

**GEROULD'S IMPROVED RETORT CEMENT**

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

*Price List, f.o.b. Galesburg or Mount Vernon.*

In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, Galesburg, Ills.

Eastern Agent, PERRY BORDEN, 19 Prospect Ave., MOUNT VERNON, N. Y.

**Parker-Russell Mining and Mfg. Co.,**

CITY OFFICE,

417 Pine Street, St. Louis, Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

**Materials for Gas Companies**

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct

Half and Full Depth Benches of Our Own Design,

Containing 6, 8 or 9 Retorts.

We have Greatly Improved our Recuperators. Coal or Coke can be used as Fuel in Furnaces.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec
A. LAMBLA, Vice-Prest. and Supt.

**BALTIMORE**

**RETORT & FIRE BRICK CO.**

MANUFACTORY AT

LOCUST POINT BALTIMORE MD.

**Clay Retorts, Blocks & Tiles**

FIRE BRICK. FIRE CLAY,
AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Baker Oven Tiles 12x12x2 and 18x18x2.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

**PRACTICAL PHOTOMETRY.**

A Guide to the Study of the Measurement of Light.

By WILLIAM JOSEPH DIBDIN.

With Numerous Illustrations Price, $3.00. A M CALLENDER & CO., 32 Pine Street, N. Y. City

# National Gas and Water Company.

CONTRACTORS FOR
**Gas Plant Machinery**

SOFT COAL OR COKE
WATER GAS GENERATORS
A SPECIALTY.

218 LA SALLE ST.,
CHICAGO.

**Gas Engineers**
INSPECTION AND ADVICE.

PLANS AND ESTIMATES
FOR IMPROVEMENTS OR
REPAIRS.

# CONNELLY IRON SPONGE AND GOVERNOR CO.,

(Successors to CONNELLY & CO.)
MANUFACTURERS OF GAS WORKS SPECIALTIES.

**"IRON SPONGE."** Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor.

**AUTOMATIC GOVERNOR.** OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT! WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION! REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE! IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

**STEAM JET EXHAUSTER.** Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

Prices given on all our specialties, delivered at any point in the United States. Correspondence solicited.

**CONNELLY IRON SPONGE AND GOVERNOR CO., No. 357 Canal St., New York.**

**Hughes'**
**"Gas Works,"**
**Their Construction and Arrangement,**
**And the Manufacture and Distribution of Coal Gas.**

Originally written by SAM'L HUGHES, C.E.

Rewritten and Much Enlarged by
WM. RICHARDS, C.E

Eighth Edition, Revised, with Notices of Recent Improvements.

**Price, $1.65.**

**A. M. CALLENDER & CO.,**
**32 Pine St., N. Y. City.**

**The Gas Engineer's Laboratory Handbook.**
By JOHN HORNBY, F.I.C.
Price, $2.50.
A. M. CALLENDER & CO., 32 Pine Street, N. Y. City.

**The Chemistry of Illuminating Gas.**
By NORTON H. HUMPH Price, $2.40.
A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY.

**Cyanogen.**
**A PURIFYING MATERIAL FOR GAS.**
Soft and porous, it can be used in the natural state without any preparation, and it ensures perfect purification.
SPECIMENS AND PRICES ON APPLICATION.

**VAN BAARDA & CO.,**
MINE OWNERS,
**DUSSELDORF-ON-THE-RHINE.**

**Parson's Steam Blower,**
FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,
FOR USING COAL TAR AS FUEL.

**PARSON'S AIR JET TUBE CLEANER,**
FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY

**H. E. PARSON, Supt., 457 Putnam Ave., Brooklyn, N. Y**

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

# THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

## Ocean Mine Youghiogheny Gas Coal,
## Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

## BERWIND-WHITE COAL MINING COMPANY'S

## Ocean Westmoreland Gas Coal.

**Offices:**
Washington Building, New York.
Betz Building, Philadelphia.

**STRICTLY** High Grade. . . . .
Carefully prepared.
For Gas Making or
Heavy Steaming.

# SCIENTIFIC BOOKS.

NEWBIGGING'S HANDBOOK. By Thos. Newbigging. 6th edition. $6.

COX'S GAS FLOW COMPUTER. $2.50.

FIELD'S ANALYSIS, 1898. $5.

HUGHES' GAS WORKS. $1.65.

POOLE ON FUELS. By Herman Poole. $3.

GAS ENGINEER'S POCKET-BOOK. By Henry O'Connor. $3.50.

TECHNICAL GAS ANALYSIS. $3.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards. 20 cents.

CHEMISTRY OF ILLUMINATING GAS. By Norton H. Humphrys. $2.40.

PRACTICAL TREATISE ON HEAT By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

GAS WORKS: Their Arrangement, Construction, Plant and Machinery. $5.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfield. $1.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

COAL: Its History and Use. By Prof. Thorpe. $3.50.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

GASFITTER'S GUIDE, by John Eldridge 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2

CONSTRUCTION OF GAS WORKS, by Walter Ralph Herring. $2.

DIGEST OF GAS CASES. $5.

PRACTICAL HINTS ON REGENERATOR FURNACES By M. Graham. $1.25.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby. $2.50.

GAS LIGHTING AND GAS FITTING. By W. P. Gerhard. 50 cents.

PRACTICAL PLUMBING. By P. J. Davies. $3.

AMERICAN PLUMBING. By Alfred Revill. $2.

CEMENT; A Manual of Lime and Cement, their Treatment and Use in Construction. By A. H. Heath. $2.50.

A COMPARISON BETWEEN THE ENGLISH AND FRENCH METHODS OF ASCERTAINING THE ILLUMINATING POWER OF COAL GAS. $1.60.

**ELECTRICITY.**

INDUSTRIAL PHOTOMETRY, with Special Application to Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Kapp. $3.50.

ELECTRICIAN'S POCKETBOOK. By Monroe and Jamieson. $2.50.

MAGNETISM AND ELECTRICITY. By J. Overend. 40 cts

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order. No books sent C.O.D.

**A. M. CALLENDER & CO., 32 Pine Street, New York.**

## The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

**DESPARD GAS COAL,**

AND MANUFACTURERS OF

**COKE.**

MINES, - - Clarksburgh, Harrison Co., West Va.
WHARVES, - - - Locust Point Baltimore, Md.
OFFICE, - 640 Equitable Building Baltimore, Md.

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS, { BANGS & HORTON 60 Congress St., Boston.

**KELLER ADJUSTABLE COKE CRUSHER.**

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

## Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

## Cox's Gas Flow Computer,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50. For sale by

**A. M. Callender & Co., 32 Pine St., N. Y.**

## GREENOUGH'S "DIGEST OF GAS CASES."

**Price, $5.00.**

This is a valuable and important work, a copy of which should be in the possession of every gas company in the country, whether large or small. As a book of reference it will be found invaluable. It is the only work of the kind which has ever been published in this country, and is most complete. Handsomely bound. Orders may be sent to

A. M. CALLENDER & CO., 32 Pine St., N. Y.

— THE —

## PENN GAS COAL CO.

OFFER THEIR

**Coal, Carefully Screened and Prepared for Gas Purposes.**

Their property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

**Room 720, Reading Terminal Building, Phila., Pa.**

**Points of Shipment:**

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River: Pier No 1 (Lower Side), South Amboy, N. J.

EDMUND H. McCULLOUGH, Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

## THE WESTMORELAND COAL CO.

Chartered 1854.

**Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.**

**POINTS OF SHIPMENT:**

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

**Principal Office, 224 South 3d St., Phila., Pa.**

## THE SUN OIL CO.

Crude Oil, Gas Naphtha,
Refined Petroleum, Gas Oil.

**Toledo, O., and Pittsburgh, Pa.**

## Standard Oil Company,

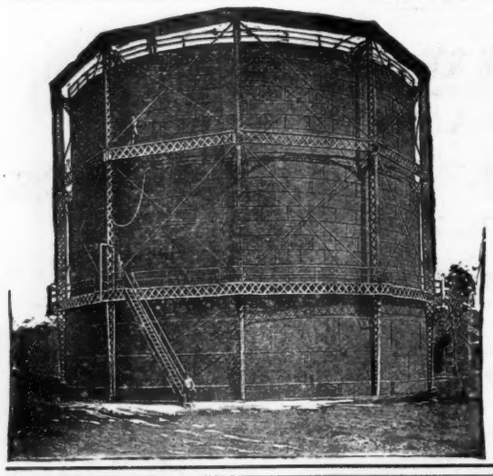
**GAS NAPTHA DEPARTMENT.**

## GAS NAPTHA.

## GAS OIL.

Correspondence Solicited.

**26 Broadway, New York City.**



## DAVIS & FARNUM MFG. CO.,
**WALTHAM, MASS.**

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Borrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

## BAXTER & YOUNG,
**CONTRACTING AND CONSULTING GAS ENGINEERS.**

Examination and Values Ascertained of Artificial and Natural Gas Properties.

**OMPLETE GAS WORKS ERECTED.**

Artificial and Natural Gas Mains Furnished and Laid.

**CORRESPONDENCE SOLICITED.**

OFFICE : WAYNE COUNTY BANK BUILDING, Rooms 201 & 202. DETROIT, MICH.

## A. E. BOARDMAN, C. E.,
**Consulting and Contracting Engineer.**

Particular attention given to Gas, Water and Electric Plants. Long and successful experience with the problem and practice of

**Filtration for Public Water Supply.**

**BREVARD, N. C.**

## Geo. Shepard Page's Sons.
**GAS MACHINERY.**

Correspondence Solicited.

**69 Wall Street, New York City.**

## JAMES T. LYNN,
**GAS ENGINEER**
AND
**CONTRACTOR,**

Wayne Bank Building, - DETROIT.

**GAS PROPERTIES PURCHASED.**

## DAVID LEAVITT HOUGH,
**Consulting Engineer**
AND
**CONTRACTOR,**
374 FIFTH AVE., N. Y

# Kerr Murray Manufacturing Company,
## Steel Gasholder Tanks,
## SINGLE, DOUBLE AND TRIPLE-LIFT GASHOLDERS,
HORIZONTAL AND VERTICAL STORAGE OIL TANKS

**Iron Work for Coal Gas Benches, Self-Sealing Mouthpieces, Exhausters, Condensers, Scrubbers, Purifiers, Wooden Trays, Floor Carriages, Center Seal and Valve System Connections, Cast and Wrought Iron Fittings, and Connections 3 to 36 Inches Diameter.**

**VALVES, Double Gate, Hub and Flange, Outside Screw and Quick Opening, 3 to 36 In. Diam.**

**COAL AND COKE WAGONS, RETORT HOUSE TOOLS, STREET MAIN SPECIALS AND DRIPS.**

Address,

## KERR MURRAY MANUFACTURING CO.
**Fort Wayne, Indiana**

# BARTLETT, HAYWARD & CO.

## BALTIMORE, MD.

## Triple, Double and Single-Lift Gasholders.

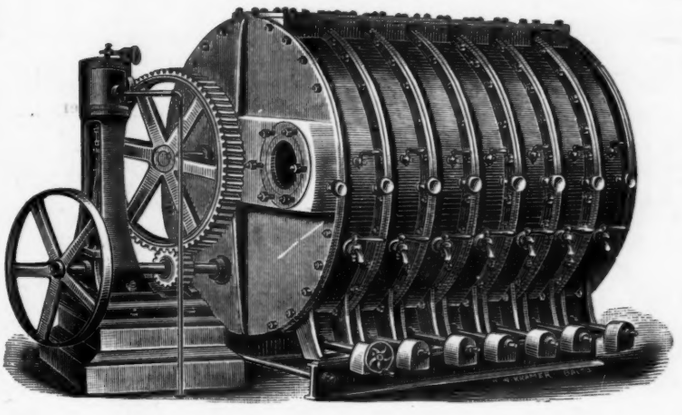
Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS

PURIFIERS.



CONDENSERS.

Scrubbers.

Bench Castings.

OIL STORAGE TANKS

Boilers.

## PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same

## The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSIBLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

**MILL'S REVERSIBLE LIME TRAYS.**

Gas Works Designed and Constructed.

## EXCERPTS FROM DECISIONS

—OF THE—

## BOARD OF GAS COMMISSIONERS of the COMMONWEALTH OF MASSACHUSETTS.

MR. E. H. YORKE, NEW HAVEN, CONN., Dec. 1, 1898.

Dear Sir:—I am in receipt of a copy of "Excerpts from the Decisions of the Board of Gas Commissioners," which is a handy compilation in book form of extracts from the most recent decisions of the Gas Commission of Massachusetts.

I note that most of these extracts are broad and safe-guiding precepts, which apply with equal force to one Company as to another. The 13 years' existence of the Board of Gas Commissioners with its unusual opportunities for acquiring information, have justly made it a high and safe authority in all matters pertaining to the management, obligations, and rights of Gas Companies. Your little book will serve as valuable reference library in settling legal complications which often arise between a Gas Company and its customers.

Yours truly, (Signed) F. C. SHERMAN, Superintendent.

A 28-page Pamphlet containing the cream of this Board's decisions as to the proper management of Gas Companies.

Compiled by E. H. YORKE. Price $1.00. Address

**A. M. CALLENDER & CO., - No. 32 Pine Street, N. Y. City.**

Foundries and Works: { Millville, N. J. / Florence, " / Camden, "

# R. D. WOOD & CO.

ENGINEERS, IRON FOUNDERS, MACHINISTS

400 Chestnut Street, PHILADELPHIA, PA.

MANUFACTURERS OF

## Cast Iron Pipe.

SOLE MAKERS OF

THE MITCHELL SCRUBBER

(PATENTED.)

PURIFIERS, CONDENSERS,
SCRUBBERS, BENCH WORK.

BUILDERS OF

## Gas Holders.

Single, Double and Triple Lifts, with or without Wrought Iron or Steel Tanks.

PEASE'S PATENT WIRE ROPE GUIDING FOR GAS HOLDERS.

CUTLER'S PATENT FREEZING PREVENTER
For Gas Holder Cups.

THE TAYLOR
REVOLVING BOTTOM GAS PRODUCER.

HEAVY LOAM CASTINGS, DUNHAM SPECIALS,
HYDRAULIC WORK, LAMP POSTS, VALVES, Etc.

# ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

## Construction and Extension of Gas Works.

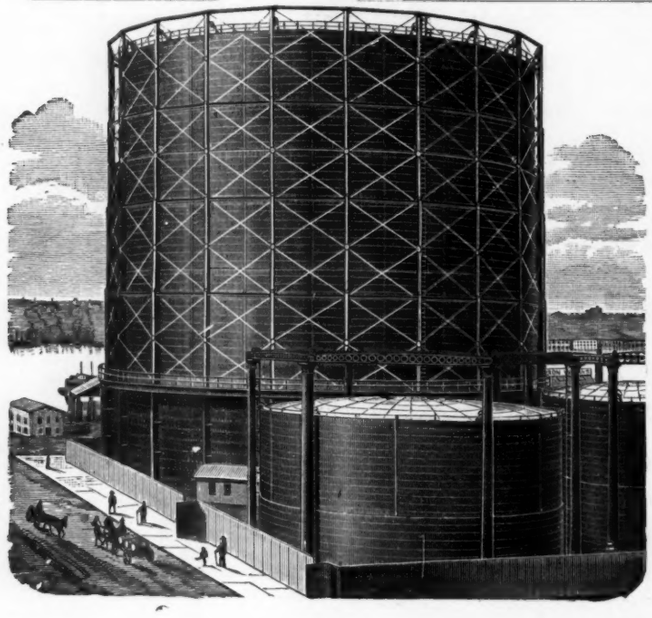
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

245 Broadway, New York City. —OFFICES— Bridge & Ogden Sts., Newark, N. J.



# The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries)
NEW YORK, Borough of Brooklyn.

BUILDERS OF

## Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

ILLUMINATING GAS! FUEL GAS!

## THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cuttlery Co., Turner's Falls, Mass., and Henry Disston's Son's Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Plans and Estimates Furnished.

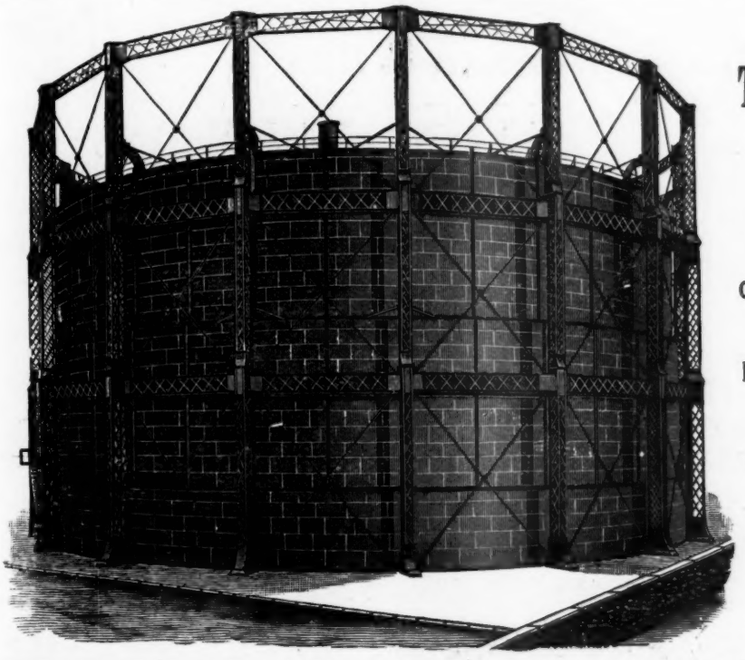
BURDETT LOOMIS, - - Hartford, Conn.

To Gas Companies.

We make to order CAP BURNERS to burn any amount under a stated pressure. Send for samples.

Also SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,
248 N. 8th St., Phila., Pa.



H. RANSHAW, Prest. & Mangr. T. H. BIRCH, Asst. Mangr.
WILLIAM STACEY, Vice-Prest. R. J. TARVIN, Sec. & Treas.

THE STACEY MANUFACTURING CO.
Established 1851.

Single, Double and Triple-Lift

GASHOLDERS,

Of any Capacity, with or without Wrought Iron or Steel Tanks.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, etc.

Coal Gas Benches, Roof Frames,

OIL STORAGE TANKS.

Pressed Steel Mouthpiece Lids, Self-Sealing Mouthpiece Lids.

Cincinnati, Ohio.

RITER-CONLEY MFG. CO.,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

WM. HENRY WHITE,

No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

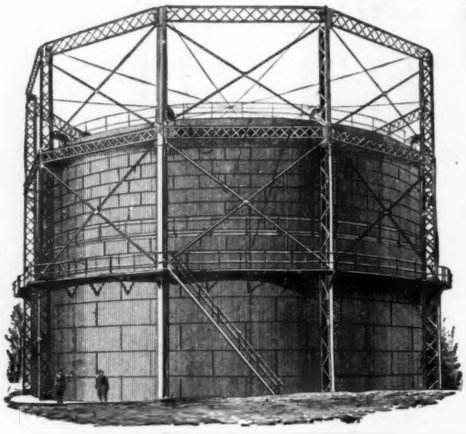
Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.
Plans and Estimates Furnished.

1899 DIRECTORY 1899

OF AMERICAN GAS COMPANIES

Price - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.



1842 ✻ Deily & Fowler, ✻ 1900

LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.

James R. Floyd's Sons,

FREDERICK W. FLOYD, President.
HENRY E. FLOYD, Vice-President.
JAMES R. FLOYD, Jr., Sec'y & Treas.

531 to 543 West 20th Street and 530 to 540 West 21st Street, N. Y.

Engineers and Contractors for the Construction of Gas Works.

MANUFACTURERS OF

All Kinds of Castings and Iron Work for Gas Apparatus.

ESTABLISHED 1856.
INCORPORATED 1899.

Write for Estimates to
539, West 20th St., New York City.

LOGAN IRON WORKS,

Brooklyn, N. Y.

BUILDERS OF

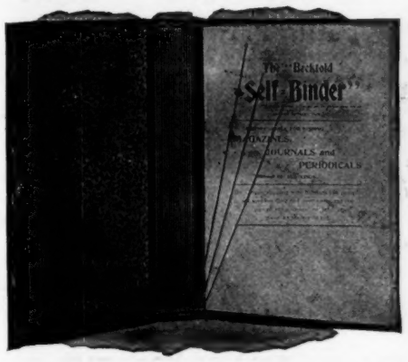
GASHOLDERS

Oil Tanks, Water Tanks, and General Wrought Iron Work.

1899 brought to us the Largest Number of Gasholder Contracts of any year in our history. Work was erected abroad as well as in many States of the Union, covering points separated by thousands of miles.

PLANS AND SPECIFICATIONS FURNISHED AND CORRESPONDENCE SOLICITED.

## BINDER for the JOURNAL.



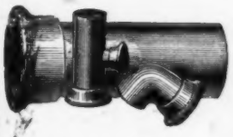

**Price $1.00.**

**A. M. CALLENDER & CO.,** 32 Pine Street, N.Y.

## WARREN FOUNDRY AND MACHINE CO.,

**Established 1856. Works at Phillipsburgh, N. J.**

**New York Office, 160 Broadway.**



CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

**Flange Pipe for Sugar House and Mine Work. Branches. Bends, Retorts, etc., etc**

"GLOBE" SPECIALS VALVES, ETC. "GLANORGAN" FIRE HYDRANTS

## M. J. DRUMMOND & CO.

MANUFACTURERS OF

CAST IRON

FLANGE

GAS AND WATER PIPE

GENERAL SALES OFFICE, 192 BROADWAY, NEW YORK.

Western Office: Monadnock Block, Chicago, Ills.

GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa

## EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF

**CAST IRON PIPE AND SPECIAL CASTINGS**

FOR WATER AND GAS.

**Also, FLANGE PIPE, LAMP POSTS, Etc.**

—THE—

## Valuation of Gas, Electricity and Water Works

**FOR ASSESSMENT PURPOSES.**

**SECOND EDITION.**

By THOS. NEWBIGGING, M.Inst.C.E., and WM. NEWBIGGING, Assoc.M.Inst.C.E.

With an Appendix of Decided Cases.

**Price $2. For Sale by**

**A. M. CALLENDER & CO.,**
**32 Pine Street, N. Y. City.**

## POOLE ON FUELS.

**THE CALORIFIC POWER OF FUELS.**

**By HERMAN POOLE, F.C.S.**

Price, $3. For Sale by

**A. M. CALLENDER & CO.,** 32 PINE ST., N.Y. CITY.

## The Gas Engineer's Laboratory Handbook.

BY JOHN HORNBY, F.I.C. Price, $2.50.

**A. M. CALLENDER & CO.,** 32 PINE ST., N. Y. CITY.

**Established 1854.**

# D. McDONALD & CO.,

MANUFACTURERS OF

## WET AND DRY METERS, STATION METERS AND METER PROVERS.

ALSO MAKERS OF

# THE GLOVER PREPAYMENT METER.

**The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.**

**The gas registered agrees absolutely with the amount purchased by the coin.**

WE HAVE MADE AND SOLD IN THE UNITED STATES

## OVER 50,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

Correspondence Solicited.

**511 West Twenty-first Street, NEW YORK.** | **51, 53 & 55 Lancaster Street, ALBANY, N. Y.** | **34 & 36 West Monroe Street, CHICAGO.**

**Established 1849.** With the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

# NATHANIEL TUFTS METER CO.,

*8 Medford Street, Boston, Mass.*

MANUFACTURERS OF

## DRY GAS METERS.

Station Meters of any Capacity.

**Test and Experimental Meters, Pressure Registers, Pressure Gauges.**

**METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.**

**Prepayment Gas Meters.**

---

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

# THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

**BALTIMORE, North & Saratoga Sts.** **CHICAGO, 107 West Monroe St.**

**SAN FRANCISCO, 221 Front St.**

**CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.**

**"Perfect" Gas Stoves**

---

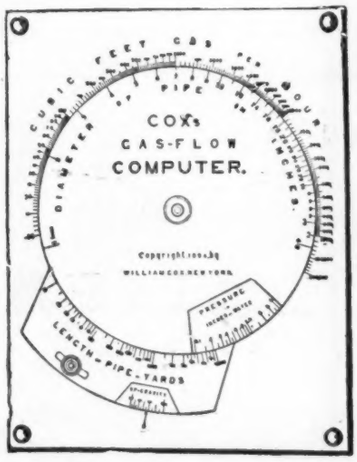
**A PERFECTLY ACCURATE METER**
**AN ALWAYS-TO-BE-DEPENDED-ON METER**
**A BEST-MADE METER**
**A SURE-TO-PLEASE METER**

# THE KEYSTONE METER

**Made at ROYERSFORD, PA.**

Pacific Coast Supplied by WIESTER & CO., 17 & 19 New Montgomery St., San Francisco, Cal.

---




# Do you wish to Know

what size of Pipe to use to convey any quantity of Gas, any distance, with any loss of pressure, and any initial or final pressure? Then use

## COX'S GAS FLOW COMPUTER,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

**Price, 6.5 x 8 inches, in cloth case, $2.50.**

For sale by

**A. M. CALLENDER & CO., 32 Pine St., N. Y. City.**

# American Meter Co.

NEW YORK, PHILADELPHIA,
SAN FRANCISCO.

## Prepayment Meters.

**Their construction is such that they may be readily readjusted when the scale of gas rates is changed.**

# HELME & McILHENNY,

Established 1848. **1339 to 1349 Cherry Street, Philadelphia, Pa.**

MANUFACTURERS OF

## Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

**METERS REPAIRED**

## PREPAYMENT GAS METERS.

**Our Own Patents. Strong. Simple.** PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

# METRIC METAL COMPANY,

MAKERS OF

## GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

**FACTORY AT ERIE, PA.**

## This is the best time to look after your repairing.

Seventy per cent. of old meters run slow. You are losing money on them. Let us put them in shape for you, a few at a time, until your entire meter equipment is made as good as new. It is better to attend to this matter now, before the Gas Stove season is at its height. Probably we can do such work in our factory better and cheaper than you can do it at home, and just now we can do it promptly.

**The BUHL METERS are as good Meters as you can get.**

## DETROIT METER COMPANY, = = Detroit, Mich.

The Advertisement of

**JOHN J. GRIFFIN & CO., Mfrs. of Gas Meters, etc.,**

Nos. 1513, 1515, 1517, 1519 & 1521 Race Street, Philadelphia,

52 Dey Street, New York, 75 N. Clinton Street, Chicago,

Occupies this space every alternate week.

# THE WESTERN GAS CONSTRUCTION CO., FORT WAYNE, IND.

## IMPROVED

# COAL GAS APPARATUS,

COMPLETE SYSTEM OF

**Exhausters, Condensers, Tar Extractors, Washers, Scrubbers, Tar Separators and Ammonia System,**

For the Complete Progressive Treatment of the Gas from the Retort Outlet to the Purifiers.

## PURIFICATION.

Ordinary Purifiers and 4-way or Valve Systems. IMPROVED DUPLEX and TWIN PURIFIERS with DUPLEX VALVE for obtaining the maximum efficiency of apparatus and economy in handling materials on minimum capital expenditure.

## Coal Gas Bench Castings.

Steel Hydraulic Mains, Self-Sealing and Common Mouthpieces, Steel Tanks, Riveted Steel Pipe, Steel Roofs and Buildings, Street Main Specials, Ammonia Apparatus, Tar Distilling Plants, Rotary Washers, Street Main Governors.

## VALVES.

Our PATENTED DESIGN, especially suitable for FOUL MAINS, for Street Mains and Works use.

## IMPROVED LOWE WATER GAS APPARATUS.

Original Installations and Auxiliary Plants and Designs for Special Situations. All capacities. Over 70 plants installed and in successful operation.

WILLIAM HENRY WHITE,
EASTERN ENGINEER,
**32 Pine St., New York.**

**The Western Gas Construction Co.,**
FORT WAYNE, INDIANA.